



Remedial Investigation Report

Martin Aaron Superfund Site

Camden, New Jersey

Volume 1 of 2

Prepared for



U.S. Environmental Protection Agency
Region II

December 2004

Prepared by



CH2MHILL

Remedial Investigation Report

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**U.S. Environmental Protection Agency
Region II**
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New York, NY 10007

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Executive Summary

The Remedial Investigation (RI) Report for the Martin Aaron Superfund Site (Site) located in Camden, New Jersey was prepared for the U.S. Environmental Protection Agency (EPA) Region II, Response Action Contract (RAC) Program by CH2M HILL. The Work Assignment Number for the RI Report is 953-RICO-02MN under RAC Contract Number 68-W6-0036. The Site is defined as the Martin Aaron Inc. property (Martin Aaron or property), and additional properties within the area of investigation, including South Jersey Port Corporation (SJPC), Comarco Products, Ponte Company, and Royal Auto Center (scrapyard). The intent of this investigation is to define the extent of soil and groundwater contamination associated with the operations undertaken at Martin Aaron, and associated operations that occurred at SJPC. Therefore, the investigation of the other properties, in addition to Martin Aaron, is necessary to define the extent of contamination. The RI Report provides the results of soil and groundwater investigations at the Site. Appendices A through H include all relevant data tables, well construction diagrams, soil boring logs, and referenced documents. Appendix I includes the Human Health Risk Assessment (HHRA). The Screening Level Ecological Risk Assessment (SLERA) is provided as Appendix J.

Remedial Investigation

ES.1 Background

The Site is located in a mixed industrial and residential setting. Soil and groundwater at the Site has been contaminated as a result of drum recycling operations at Martin Aaron. SJPC, located across the street from Martin Aaron, and adjacent properties including a scrapyard, Comarco Products, and the former Ponte Company were also evaluated as a part of the RI.

Martin Aaron Inc. purchased the Martin Aaron property in 1969 and began operating a drum reconditioning facility. Martin Aaron was used by various owners and operators for this purpose until operations ceased in 1998.

Between 1981 and 1993, inspections conducted by EPA and the New Jersey Department of Environmental Protection (NJDEP) at Martin Aaron identified unpermitted discharges of hazardous waste from leaking drums and roll-off containers. Anonymous reports indicated that drums of containerized waste were buried at Martin Aaron. Sampling events conducted by NJDEP between 1986 and 1993 identified organic and inorganic constituents in sewer basins and drums at the property.

NJDEP conducted a three-phased RI at Martin Aaron, and the surrounding area, including SJPC, Comarco, Everett Street, Sixth Street, and Jackson Street between May 1997 and March 2000. The investigations were conducted between May and September 1997, between September and November 1998, and between December 1999 and March 2000. Soil and groundwater samples were collected from Martin Aaron and surrounding areas which were suspected to be impacted by contamination from the property.

The results of the NJDEP RI determined that surface and subsurface soil at Martin Aaron and the surrounding properties contained levels of organic and inorganic constituents in excess of the NJDEP soil cleanup criteria. The primary constituents of concern (COCs) within the surface and subsurface soil include chlorinated and aromatic volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), and metals. The results of the NJDEP RI also determined that shallow groundwater was contaminated above NJDEP Groundwater Quality Criteria (GWQC), including chlorinated and aromatic VOCs, SVOCs, pesticides/PCBs, and metals. Contaminants identified in the deeper portions of the aquifer included chlorinated hydrocarbons and metals, but with much fewer compounds and lower concentrations than encountered in the shallow portions of the aquifer. The NJDEP RI also included a subsurface geophysical investigation to identify the location of buried drums at Martin Aaron. These results are included in an RI Report for the Martin Aaron Site dated October 2000.

ES.2 Site Characteristics

The Site is located in the New Jersey Coastal Plain physiographic province in an area underlain by moderate thickness (greater than 300 feet) of highly permeable, unconsolidated sediments of the Pleistocene and Cretaceous age. Surficial soils at the Site represent Pleistocene age deposits of the Freehold-Downer Urban Land Complex soil associations. The unconsolidated sediments immediately underlying the Pleistocene deposits consist primarily of sands and gravels with intervals of silts and clays classified as continental, coastal, or marine type deposits.

The Site is located within the outcrop area of the Potomac-Raritan-Magothy (PRM) Aquifer System. Five mappable hydrogeologic units are defined within the PRM Aquifer System. These units include three aquifers identified as the Upper, Middle, and Lower units, and two confining beds. The PRM System in the Site area has been observed to be over three hundred feet thick. The nearest surface water body to the Site is the Delaware River, which lies approximately 0.75 miles to the west. Additional surface water bodies include the Cooper River, which is located approximately 2 miles north-northeast of the Site, and Newton Creek, which is located approximately 1.5 miles south of the Site.

Groundwater is not used as a drinking water source at Martin Aaron, the surrounding properties, or SJPC. Camden County Municipal Utility Authority (CCMUA) provides drinking water to the City of Camden using water supply wells which draw water locally from the PRM Aquifer System. CCMUA provides drinking water to approximately 105,000 people within four miles of the Site. The nearest CCMUA well is located approximately 1.75 miles east-northeast of the Site. This well (City Well 7) is used as an emergency water supply well only and was not in use during the RI. However, this well was sampled as part of the RI.

There is currently one building remaining in the southeastern portion of the property. The main building, identified as the Martin Aaron Building, was demolished by the City of Camden in 1998. Between 1997 and 1999, NJDEP removed contaminated soil, buried drums, aboveground and underground storage tanks, and sewer basins from Martin Aaron.

ES.3 Site Investigation

Surface soil samples were collected from 60 locations at the Site. These sampling locations include the SJPC property, the scrapyard, Comarco Products, the Ponte Company, and locations on Everett Street and Sixth Street. Surface soil samples were collected to two feet below grade. Samples were collected from the upper six inches of soil if there was no gravel or concrete present to impede sample collection. Subsurface soil samples were collected at 72 sampling intervals including the 60 surface soil locations and 12 monitoring well locations at depths ranging from greater than two feet below ground surface (bgs) to approximately twenty-one feet bgs.

A total of 24 monitoring wells were installed as part of this RI. Ten wells, installed during the NJDEP's RI, were also sampled in order to evaluate hydrogeologic conditions and groundwater quality beneath the Site. Two rounds of groundwater sampling were conducted from June 12 to June 28, 2002, and September 17 to September 25, 2002. The 24 newly installed monitoring wells were located on Martin Aaron, SJPC, Everett Street, Sixth Street, and Jackson Street. Eleven "shallow" monitoring wells were installed across the water table in the Upper PRM Aquifer, seven "intermediate" wells were installed near the middle of the Upper PRM Aquifer, four "regional" wells were installed near the bottom of the Upper PRM Aquifer, and four "deep" wells were completed at the top of the Middle PRM Aquifer. The interbedded nature of the Upper and Middle PRM Aquifers sometimes precluded screening target intervals for groundwater monitoring. A CCMUA emergency water supply well, located approximately 1.75 miles from the Site, was also sampled in order to determine if contaminants from the Site have migrated to this well.

The six time-stratigraphic units beneath the Site can be categorized into hydrostratigraphic units according to their hydraulic properties and significance. The Site is underlain by three aquifers and three confining units as follows: the Upper PRM Aquifer, an intermittent confining unit that includes interbedded sand, the Middle PRM Aquifer, a continuous clay confining unit, the Lower PRM Aquifer, and a basal confining unit. The Upper and Middle PRM Aquifers were evaluated for this RI.

The Upper PRM Aquifer is under unconfined conditions and consists of sandy soils of the Magothy Formation in hydraulic connection with the surficial anthropogenic fill materials. The Upper PRM Aquifer ranges in thickness from 94 ft to 110 ft. The Surficial Upper PRM Aquifer is underlain by an intermittent confining unit that separates the Upper PRM from the Middle PRM Aquifer. The Middle PRM consists of sands and gravels of the Potomac Formation approximately 100 ft thick.

The groundwater in the Upper PRM Aquifer generally flows to the east-southeast, away from the Delaware River. As only two monitoring wells were installed in the Middle PRM Aquifer, the groundwater flow direction in the unit was not determined.

Soil and groundwater samples were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, Target Analyte List (TAL) metals, and PCBs. Natural attenuation parameters were also analyzed in accordance with EPA's Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, 1998. Soil and groundwater samples were submitted to an EPA-approved laboratory. Quality Assurance/Quality Control (QA/QC) samples were also collected to ensure the validity of the analyses performed.

A safety inspection was conducted at the Rhodes Drum Building, the only remaining structure at Martin Aaron. The results of the inspection determined that no activities could be performed inside the building without structural overhead protection or roof removal. Therefore, no sampling was conducted inside the Rhodes Drum Building.

ES.4 Nature and Extent of Contamination

The results of the soil investigation conducted as part of the RI are provided below. Soil concentrations were compared to the EPA Generic Soil Screening Level (SSL) for Migration to Groundwater, the NJDEP Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC), and the NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC) for each constituent detected.

Surface Soil

- VOCs were detected above screening levels in samples collected from Martin Aaron, but not the surrounding properties included in the RI. The most commonly detected VOCs in surface soil at Martin Aaron include tetrachloroethylene (PCE), trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), vinyl chloride, and benzene. The presence of VOCs at Martin Aaron results from former drum recycling operations;
- SVOCs were identified at Martin Aaron, SJPC, Comarco Products, and the Ponte Company at concentrations above screening levels. The SVOCs detected most frequently include: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, n-nitrosodiphenylamine, pentachlorophenol, and pyrene. These compounds are most likely present, as a result of combustion activities and the presence of fill material;
- Metals above screening levels were detected in virtually all of the surface soil samples collected from Martin Aaron and the surrounding properties. Metals are present at elevated concentrations in surface soil samples collected at locations upgradient from the Site, and are generally found at all sampling locations far from suspected Martin Aaron contaminant source areas. Therefore, it is suspected that metals exist at elevated levels due to the presence of fill material as well as resulting from former drum recycling activities. Arsenic, barium, and lead were detected most frequently; and
- Pesticides, including aldrin and dieldrin, were found at several sampling locations at Martin Aaron, Comarco Products, Everett Street, and Sixth Street. PCBs were detected above screening levels in surface soil samples collected at the Site.

Subsurface Soil

- VOCs were detected at Martin Aaron, and one upgradient location north of the property on Everett Street. The VOCs detected most frequently included: TCE, PCE, cis-1,2-DCE, 1,1,1-trichloroethane (TCA), vinyl chloride, chlorobenzene, 1,1-DCE, methylene chloride, chloroform, and 1,2,4-trichlorobenzene, benzene, and toluene.

Only benzene was detected at the upgradient location in a relatively low concentration. The most commonly detected VOC at Martin Aaron was PCE. The results show that drum recycling operations contributed to VOC contamination in subsurface soil at the property. However, the detection of benzene in an upgradient well indicates a potential upgradient source of VOC contamination;

- SVOCs were identified above screening levels at Martin Aaron, sampling locations on Everett Street and Sixth Street, and SJPC. SVOCs detected most frequently in subsurface soil include: benzo(b)fluoranthene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, carbazole, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, n-nitrosodiphenylamine, isophorone, naphthalene, di-n-butyl phthalate, 3,3-dichlorobenzidine, chrysene, and pyrene. There were no SVOCs detected above the screening criteria at Comarco, Ponte Company, or the scrapyard. The results indicate that SVOCs have migrated to subsurface soils, as a result of operations at Martin Aaron, SJPC, and surrounding properties, as well as contributions from the presence of fill material at these properties. Elevated SVOCs were identified in the northeastern corner of SJPC. It is suspected that a former service station located to the north of SJPC may have contributed to the SVOC contamination at this location;
- Metals were found on all properties sampled and at most sampling locations. Metals above screening levels include: antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium and thallium. The metals are likely attributed to the presence of fill material at these sampling locations; and
- Pesticides were detected, above screening levels, in subsurface soil at the Martin Aaron property, Comarco Products, and sampling locations on Everett Street and Jackson Street. In general, pesticide concentrations were relatively low. Beta-benzene hexachloride (BHC) and dieldrin were the pesticides identified most frequently. PCBs were detected above screening levels in subsurface soil samples collected at the Site.

Groundwater

Two rounds of sampling were conducted as part of this RI, from June 12 to June 28, 2002 and from September 17 to September 25, 2002. Groundwater results were compared to the more stringent of the EPA Maximum Contaminant Level (MCL) and the NJDEP GWQC.

Surficial Upper PRM (Shallow) Aquifer

Eighteen groundwater samples were collected from the Surficial Upper PRM Aquifer at the Site. VOCs detected above screening levels include: benzene, cis-1,2-DCE, TCE, 1,1-DCE, 1,2-dichloropropane, 1,2,4-trichlorobenzene, 1,1,1-TCA, vinyl chloride, xylene, 1,2-DCE, and PCE. SVOCs were detected at groundwater sampling locations on Martin Aaron, Everett Street, and Sixth Street at concentrations above screening levels including n-nitrosodiphenylamine, phenol, and bis(2-chloroethyl)ether. Metals above screening levels include aluminum, antimony, arsenic, barium, cadmium, chromium, iron, lead, manganese, sodium, and thallium. Aldrin, dieldrin, and BHC were the most commonly detected pesticides.

Intermediate Upper PRM (Middle) Aquifer

VOCs detected above screening levels include TCE, cis-1,2-DCE, vinyl chloride, dichloropropane, and benzene. VOCs were primarily identified in groundwater samples collected from Martin Aaron. SVOCs were not detected above screening levels. Metals identified above screening levels are aluminum, antimony, arsenic, beryllium, cadmium, iron, manganese, sodium, and thallium. Pesticides and PCBs were not detected above screening levels.

Basal Upper PRM (Regional) Aquifer

Four groundwater samples were collected from the Basal Upper PRM Aquifer and from a sand unit that occurs within the multiple clay beds that comprise the intermittent confining unit between the Upper and Middle PRM Aquifers. The Basal Upper PRM Aquifer is referred to as the "Regional" Aquifer in this RI Report. During this RI three regional monitoring wells were set at the base of the Upper PRM Aquifer at the Site. VOCs were detected in all four of the regional groundwater sampling locations. TCE and vinyl chloride were the constituents identified in the former drum area in the southwest corner of the Martin Aaron property, and downgradient of the property to the southeast. SVOCs, pesticides, and PCBs were not detected. However, metals were detected in all four wells. The metals detected above screening levels include: aluminum, beryllium, iron, manganese, sodium, and thallium.

Upper Middle PRM (Deep) Aquifer

Two groundwater samples were collected from the Upper Middle PRM Aquifer at the Site. No VOCs or SVOCs were detected in the two rounds of groundwater sampling from these wells. However, metals were detected above screening levels in the two samples including aluminum, beryllium, iron, lead, manganese, sodium, and thallium.

ES.5 Fate and Transport

The primary COCs in the soil and groundwater at Martin Aaron are VOCs including: TCE, PCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, vinyl chloride and chloroethane. In addition, benzene, toluene, ethylbenzene, and xylene (BTEX) are also COCs at Martin Aaron.

Contaminants move vertically by gravity and laterally under the influence of the ambient hydraulic gradient upon reaching the water table in the Upper PRM Aquifer. Contaminant concentrations in wells located southeast of Martin Aaron indicate that VOC contamination has migrated beyond the property boundary in the groundwater.

With respect to concentrations below detection limits, the horizontal extent of VOC contamination has not been delineated in the Surficial Upper PRM Aquifer to the east, southeast, and south of the Site, the Intermediate Upper PRM Aquifer to the west, south and southeast of the Site and the Basal Upper PRM Aquifer in all directions from the Site.

Based on groundwater data collected for this RI, the VOC plume has been determined to be over 1000 ft long and approximately 600 ft wide in the Surficial Upper PRM Aquifer, but narrows with depth to approximately 400 ft wide in the Intermediate Upper PRM Aquifer. Vertically, the bottom of the plume appears to be defined by the interbedded, intermittent

confining unit between the Upper PRM and the Middle PRM Aquifers. The confining unit contains thin sand beds. Wells installed in the sand unit exhibited elevated VOC concentrations.

Historically VOCs and other constituents were introduced into the soil and groundwater from leaking and/or buried drums at the property. Remedial actions have been taken to eliminate sources of contamination at Martin Aaron including the removal of buried drums, underground storage tanks (USTs), aboveground storage tanks (ASTs), and sewer basins. However, due to the presence of these sources, and the resulting contamination of the soil, constituents leach from the soil and are transported downward to the water table by infiltrating precipitation. Once in the Surficial Upper PRM aquifer, the contaminants are transported both vertically and laterally, spreading outward and along the path of groundwater flow away from the original source areas. The many intermittent clay beds help to spread contaminant migration laterally.

The vertical extent of contaminant migration is delineated by the intermittent confining unit between the Upper and Middle PRM aquifers at a depth of approximately 140 feet below ground surface. The lateral extent of contaminant migration is beyond the downgradient monitoring wells surrounding Martin Aaron.

Decreases in groundwater contaminant concentrations indicate that the plume is not likely as long as projected by groundwater velocities. Thus natural attenuation (NA) processes appear to be a factor in limiting contaminant migration.

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- G Analytical Results
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Acronyms

AC&C	American Chain and Cable Company
Amsl	above mean sea level
AST	aboveground storage tank
bgs	below ground surface
BHC	Benzene hexachloride
BOD	biological oxygen demand
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CCMUA	Camden County Municipal Utility Authority
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	contract laboratory program
COC	constituents of concern
COD	chemical oxygen demand
COPC	contaminant of potential concern
CVOC	chlorinated volatile organic compound
DAF 20	Dilution Attenuation Factor 20
DCA	dichloroethane
DCE	dichloroethylene
DNAPL	dense nonaqueous phase liquid
EPA, USEPA, U.S. EPA	U.S. Environmental Protection Agency
EQulS	Environmental Quality Information System
ERA	Ecological Risk Assessment
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
Gpm	gallons per minute
GPR	ground penetrating radar

GWQC	Groundwater Quality Criteria
HHRA	Human Health Risk Assessment
ID	inside-diameter
IDW	investigation-derived waste
IGWSCC	Impact to Groundwater Soil Cleanup Criteria
ISRA	Industrial Site Recovery Act
MCL	Maximum Contaminant Limit
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spike duplicate
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
NJ GWQS	New Jersey Groundwater Quality Standards
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJDWS	New Jersey Drinking Water Standard
NOV	Notice of Violation
NPL	National Priorities List
NRDCSCC	Non-Residential Direct Contact Soil Cleanup Criteria
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
PP metals	priority pollutant metals
PPE	personal protective equipment
ppm	parts per million
PQL	practical quantitation limit
PRM	Potomac-Raritan-Magothy

QA/QC	quality assurance/quality control
RAC	Response Action Contract
RDCSCC	Residential Direct Contact Soil Cleanup Criteria
RI	Remedial Investigation
RIW	Remedial Investigation Workplan
SJPC	South Jersey Port Corporation
SOP	Standard Operating Procedure
SSL	Generic Soil Screening Level
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List
TCL VOC	Target Compound List Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
Tech Regs	NJDEP's <i>Technical Requirements for Site Remediation</i>
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSS	total suspended solids
UBO	unidentified buried object
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USGS	United States Geologic Survey
UST	underground storage tank
VOC	volatile organic compound
WWTP	wastewater treatment plant

1. Introduction

1.1 Purpose

The Remedial Investigation (RI) Report presents the results of the field activities conducted at the Martin Aaron Superfund Site (Site) located in the City of Camden, Camden County, New Jersey (Figure 1-1). The Site is defined as Martin Aaron Inc. property (Martin Aaron or property), located at 1542 South Broadway, and additional properties within the area of investigation, including South Jersey Port Corporation (SJPC), Comarco Products, Ponte Company, and Royal Crown Auto Center (scrapyard) as shown on Figure 1-2. The intent is to define the extent of soil and groundwater contamination at the Site associated with the operations undertaken at Martin Aaron and associated operations at SJPC. Therefore, the investigation of the other properties is necessary to define the extent of contamination. A Feasibility Study (FS) will also be prepared following approval of the RI Report. The purpose of the Remedial Investigation/Feasibility Study (RI/FS) is to select a remedy to eliminate, reduce, or control risks to human health and the environment.

CH2M HILL was contracted by the United States Environmental Protection Agency (EPA) to conduct an RI/FS for the Site in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). In addition, the RI has been prepared in accordance with the New Jersey Department of Environmental Protection (NJDEP) Solid Waste Regulations, specifically the New Jersey Administrative Code (NJAC) Section 7.26E-4.8, which provides the NJDEP requirements for preparation of RI Reports. This RI Report meets the requirements of the EPA and NJDEP regulations and relevant guidance for RI preparation.

1.2 Overall Remedial Investigation Objectives

In May 1997, NJDEP initiated an RI/FS to determine the nature and extent of contamination throughout the Site and the risks it poses. The Site was placed on the National Priorities List in 1999, while the RI/FS activities were underway. Upon completion of the NJDEP's RI/FS in June 2000, the EPA became the lead agency for the Martin Aaron Site. In order to further characterize Site conditions, including soil and groundwater contamination, EPA elected to perform an all inclusive RI/FS based on the evaluation of the findings of previous investigations along with further soil and groundwater sampling results.

The RI's broad objectives are to evaluate the impact of drum recycling and reconditioning operations at Martin Aaron on surface and subsurface soils and groundwater at the Site. In addition, data was obtained to evaluate the nature and extent of soil and groundwater contamination associated with former Martin Aaron drum recycling operations, assess the associated human health risks, and evaluate appropriate remedial alternatives. The SJPC property is located across from Martin Aaron at 1535 South Broadway, and adjacent

properties, including the scrapyards on Everett Street, Comarco Products at Broadway and Jackson Street, and the former Ponte Company property which is an abandoned warehouse on Sixth Street, were also evaluated as part of this RI. Specific RI/FS objectives for each environmental medium are identified below. Objectives were developed in consultation with EPA, based on observations during preliminary Site visits, current Site conditions, available information on past activities and suspected source areas, and available soil and groundwater contamination data.

1.2.1 Surface and Subsurface Soils

Previous investigations, including the NJDEP RI, confirmed the presence of constituents of concern (COCs) in surface and subsurface soils at the Site. The COCs identified included: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals. Since the completion of the NJDEP RI field-sampling activities, various structures and contaminated soil have been removed from Martin Aaron.

This RI evaluates the following for surface soil at the Site:

- the lateral extent of surface soil contamination; and
- the potential human health and ecological risks associated with any contamination found in the surface soil at the Site.

This RI evaluates the following for subsurface soil at the Site:

- the lateral and vertical extent of contamination in the unsaturated subsurface soils;
- the presence of dense nonaqueous phase liquid (DNAPL) and radioactivity in the unsaturated subsurface soils during the boring installation program;
- Site geologic conditions, including lithology and the physical and chemical properties of the underlying soil; and
- the potential human health and ecological risks associated with any contamination found in the subsurface soils.

1.2.2 Groundwater

The NJDEP RI determined that groundwater contamination was detected in both the shallow and deep portions of the Upper Potomac-Raritan-Magothy (PRM) Aquifer at the Site.

This RI will evaluate the following for groundwater at the Site:

- the vertical and horizontal extent of contamination within the Upper PRM Aquifer that can be attributed to Martin Aaron drum recycling operations. This includes investigating contamination within the Upper PRM Aquifer beneath (and upgradient of) suspected Martin Aaron source areas;

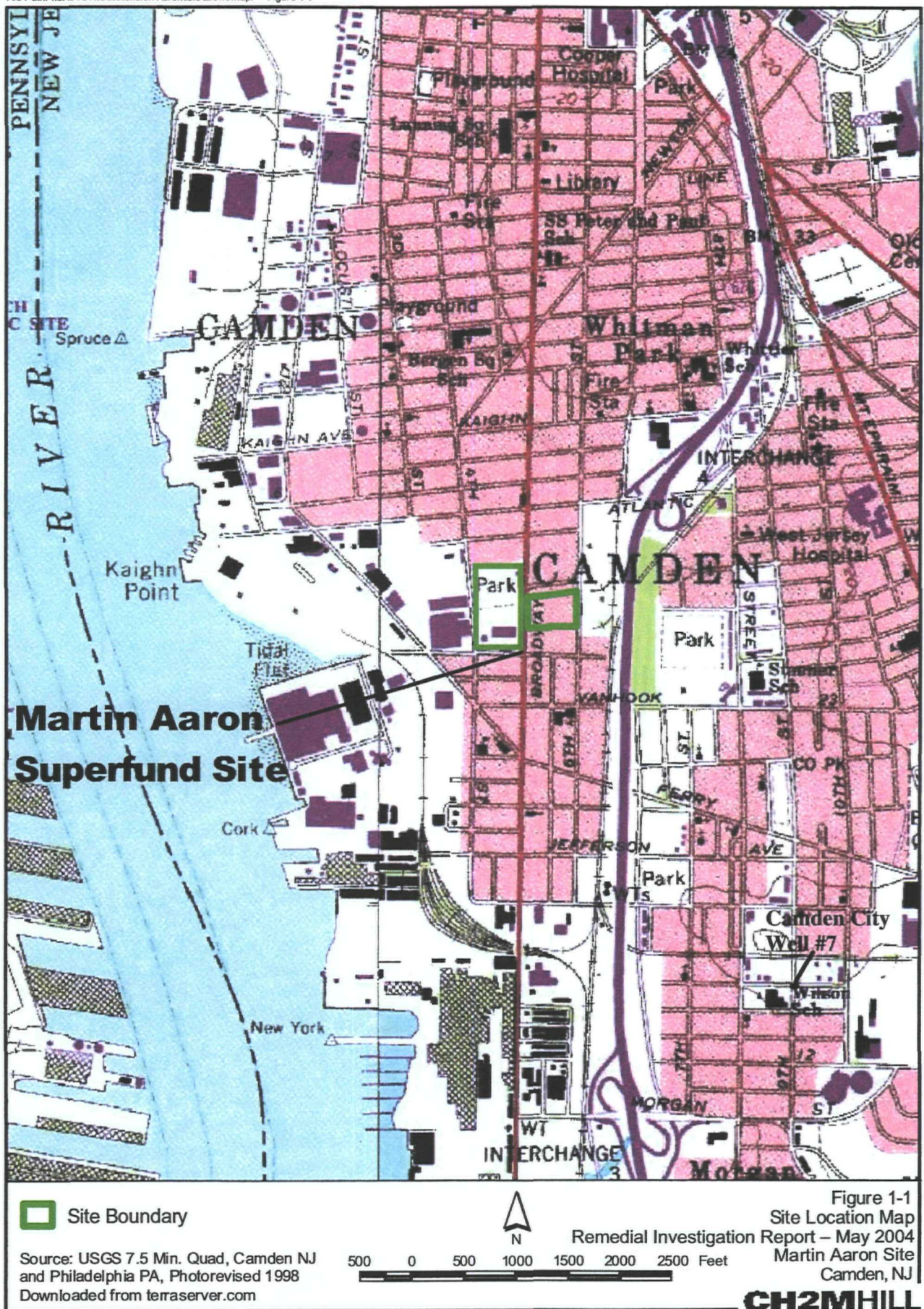
- the vertical and horizontal extent of the groundwater contaminant plume that may have migrated beyond the property boundary. This includes an investigation of contamination downgradient within the Upper PRM Aquifer;
- the hydrogeologic conditions influencing contaminant migration in the Upper PRM Aquifer at the Site;
- the hydrogeologic and engineering information necessary for a remedial alternatives evaluation; and
- the potential human health and ecological risks associated with groundwater contamination at the Site.

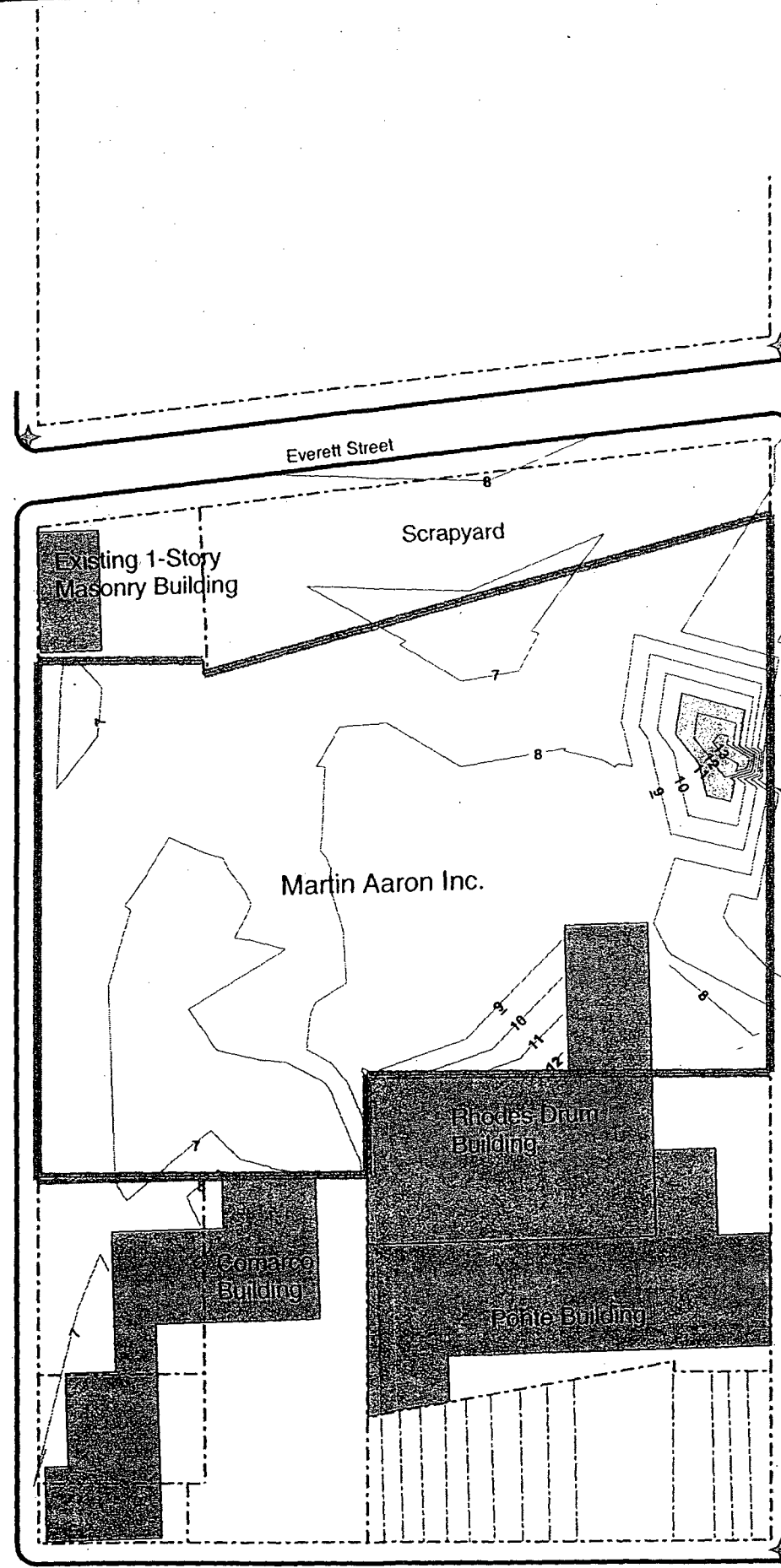
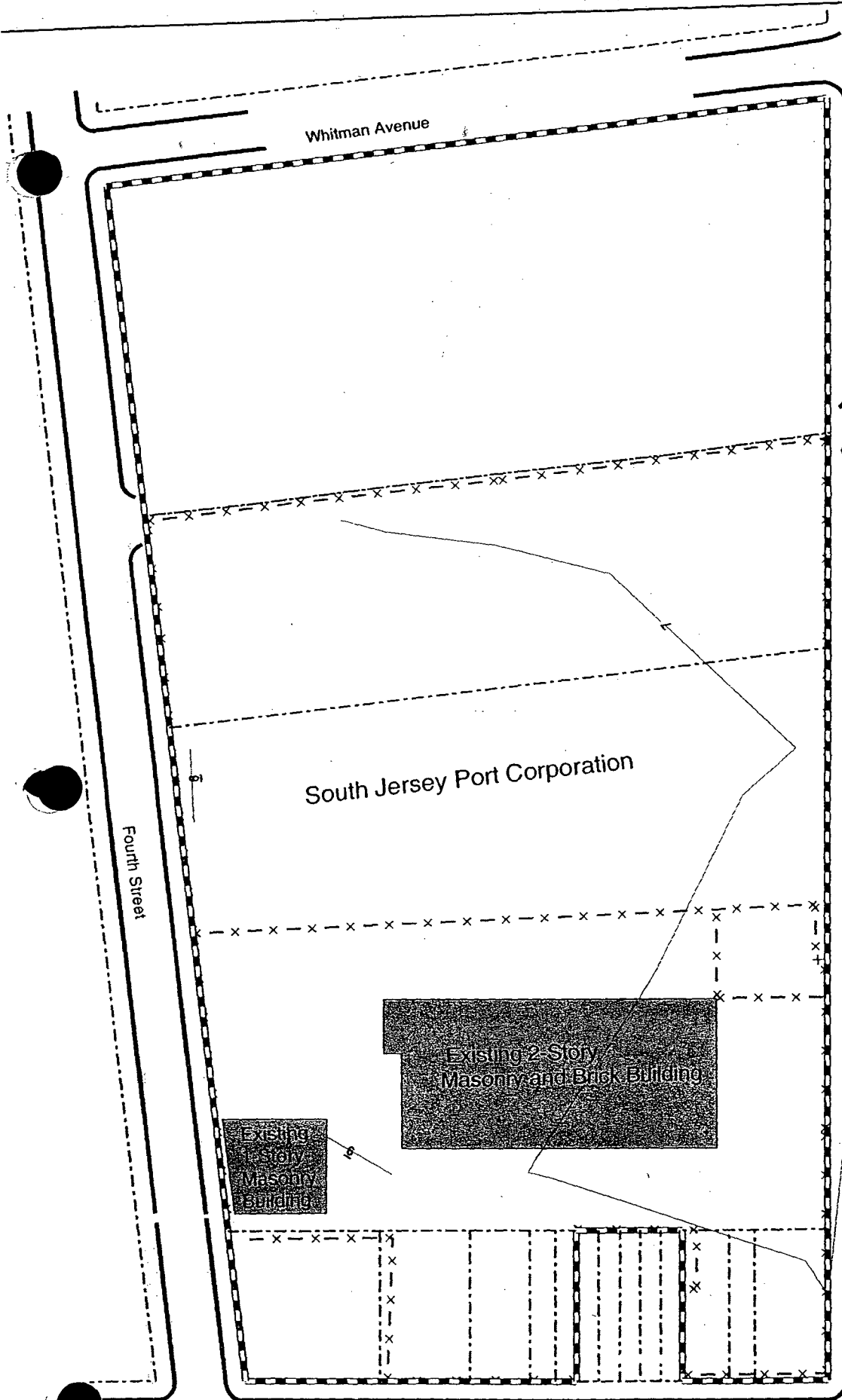
1.2.3 Rhodes Drum Building

There is one remaining building at the Site, referred to as the "Rhodes Drum Building," where former drum recycling and reconditioning operations took place. The RI will include an evaluation of the following:

- The structural stability of the Rhodes Drum Building prior to implementation of any field sampling activities; and
- A determination, using the collection of wipe and chip samples, if residual contamination is present which could pose potential risks to human health and/or affect the future actions for the building.

301883





Legend

- ◆ City Monument/Benchmark
- Tax Parcel Boundaries
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- Countours
- Streets
- x - x - Fence Lines
- ~ Wall
- Structures
- Debris Pile
- 10 - Elevation Contour

0 50 100 200 Feet

Figure 1-2
Martin Aaron Site Layout and Topography
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

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2. Site Background

This section describes the Martin Aaron property including its location, local historical land uses, former operations, the regulatory history, and a summary of previous investigations and remedial activities. As defined in Section 1, the Martin Aaron Superfund Site is defined as the Martin Aaron Inc., and additional properties within the area of investigation, including SJPC, Comarco Products, Ponte Company, and an adjacent scrapyard. The intent is to define the extent of soil and groundwater contamination associated with the drum recycling operations undertaken at Martin Aaron and the drum storage that occurred at SJPC. The information in this section was obtained primarily from *Remedial Investigation Report for the Martin Aaron Site, Camden City, Camden County, New Jersey* (RI Report, October 2000), prepared by L. Robert Kimball and Associates, Inc. for the NJDEP.

2.1 Site Description

The 2.4-acre Martin Aaron Property is located at 1542 South Broadway in the City of Camden, Camden County, New Jersey (Figure 1-1) and identified as Lot 1 of Block 460 in the Camden County Tax Assessor records for the City of Camden. It is situated on relatively level land in an area of mixed-industrial and residential properties. Access is restricted by a chainlink fence with two locked gates. Beginning in 1969, various companies, including Martin Aaron, used the property for drum recycling. The owners and operators are provided in Section 2.2.

The only remaining surface structure, the Rhodes Drum Building, is located in the southeastern portion of the property. Prior to the demolition of buildings, the property also consisted of a main building identified on Figure 2-1 as the Martin Aaron Building, formerly located in the southwestern portion of the property. The Rhodes Drum Building, and the former Martin Aaron Building, were both used for drum recycling and reconditioning operations. Three underground storage tanks (USTs) were located in the processing area just north of the main building, and one was located east of the main building (Figure 2-1). Seven aboveground storage tanks (ASTs) located west of the Rhodes Drum Building (Figure 2-1) were also present when Martin Aaron was an operating facility. The remaining concrete floor of the former building contained a number of floor drains that led to three former Sewer Basins (Numbers 1, 2, and 3) located near the main building. According to former operators, all three reportedly received drum rinsate, and discharged to the Camden County Municipal Utility Authority (CCMUA) sanitary sewer system.

The actual destination of discharge for Sewer Basins 2 and 3 remains unknown. One processing vessel and Sewer Basin 4 were located near the Rhodes Drum Building's eastern end. This basin received drum-rinsate effluent from Rhodes Drum Company operations and discharged to the CCMUA sanitary sewer system, following pre-treatment activities. One of the ASTs was located adjacent to Sewer Basin 4. The remaining portions were historically used for drum storage and consist of paved and unpaved surfaces. Sewer Basins 1, 2, 3, and 4 are shown on Figure 2-1.

An additional property of concern, owned by the SJPC, is west of Martin Aaron, at 1535 South Broadway Street (Lot 15, Block 458). This property is shown on Figure 1-2. The SJPC property was formerly leased to Wadco, which used it for office space and drum receiving/sorting. Three commercial buildings occupy the SJPC lot, with the remaining acreage consisting of paved and unpaved lots. Access is also restricted by a chainlink fence and locked gate. Additional properties evaluated in this RI are shown on Figure 1-2 and include the following:

- An active scrapyard north of Martin Aaron between Broadway and Sixth Street on Everett Street;
- Comarco Products, an active meat-processing plant is located at 501 Jackson Street; and
- An abandoned warehouse owned by the Ponte Company south of Martin Aaron on Sixth Street, which is adjacent to the residences on Jackson Street.

2.2 Site History

Historical records indicate that Martin Aaron has been used for light industrial activities since 1886. From 1887 to 1908, Kifferty Morocco Manufacturing Company operated a leather-tanning and glazing business. Martin Aaron was purchased and owned by the Castle Kid Company from 1908 to 1940, and produced matte and glazed kid leathers. During this time the facility grew and added a railroad spur, a 200-gallon gasoline UST (located in the northeastern corner), coal stockpiles, a laboratory, a cafeteria, a liming system with four aboveground settling tanks (in the northeastern corner) and an 85,000-gallon suction tank.

The property was seized by the City of Camden due to tax delinquency in 1940 and sold to Benjamin Schmerling. It was then leased to H. Preston Lowden Company (Preston) and American Chain and Cable Company—Pennsylvania Lawn Mower Division (AC&C). Preston leased building space in the southwestern corner of and operated a hair-and-wool blending business. AC&C leased building space in the southeastern corner for use as the physical plant area of its manufacturing facility.

Martin Aaron, Incorporated (Martin Aaron) purchased the property from Benjamin Schmerling in 1969, and is currently the owner of record. From 1969 to 1985, Martin Aaron operated a drum recycling business as Drum Services of Camden. In 1985 the business was sold to a corporation jointly run by Westfall Ace Drum Company (Wadco) and Rhodes Drum Incorporated (Rhodes), two major clients of the former Drum Services of Camden. Wadco occupied the majority of the remaining structures, while Rhodes operated from a building in the southeastern corner. Wadco ceased operations in March 1995, while those at Rhodes ceased permanently by spring 1998.

2.3 Site Operations

Drum Services of Camden and more recently, Wadco, Drum Services of Richmond, and Rhodes all operated steel drum reconditioning facilities at the property. The description of

Martin Aaron operations provided in this section was obtained from the NJDEP Bureau of Planning and Assessment Case History Report (1988).

Based on the NJDEP report, empty drums were transported to the facility via tractor trailer. As drums were brought onto Martin Aaron or SJPC (across the street at 1535 S. Broadway) they were segregated by type (open lid as opposed to bung-type) and visually or manually inspected to determine the amount of residual material, if any, remained in the drum. If more than one inch of residue was present, the drum was returned to the customer. If less than one inch remained, the drums were taken into the facility, turned upside down over grate-covered, square-bottomed tanks and allowed to drain. After the residuals had drained, the drums were then pressure washed with a caustic solution, and allowed to drain. The drums were then washed, rinsed, and steamed dry. After drying, the drums were inspected for integrity. Dents were removed pneumatically and the drums were sandblasted with a fine steel-pellet grit in preparation for final painting. A dust collection system (baghouse) was utilized during this operation. The drums were then taken to the paint booth, where an enamel oil-based paint was applied. The drums were allowed to dry and then transported off the property. The estimated generation of hazardous waste from these activities was 30 55-gallon drums every 60 to 90 days.

The drum residue, rinsate runoff, and steam blowdown were collected in drainage tanks and floor drains that fed to four skimming basins. Basins 1,2, and 3 collected effluent from the building occupied by Wadco and Basin 4 received effluent from the Rhodes building. The locations of the basins are shown on Figure 2-1. The steam tanks, pump tanks, and floor drains/trenches were skimmed periodically. Sludge was removed and drummed every two to three months. The water in the vessels was reused with approximately two gallons of caustic added to the steam tanks daily.

Basin 1 was located in the former processing area within the former Martin Aaron building. The basin consisted of a baffled concrete pit, approximately 4 feet (ft) by 8 ft and approximately 5 ft deep. A submersible pump was located in the influent side that activated a wastewater neutralization system when triggered by rising water levels. This system was designed to lower the pH of the potential effluent (usually 12 to 14) to the pH limit (6 to 9) mandated by the CCMUA permit No. 3412-CA-1 requirements. However, reports indicate that a pipe existed between the baffle walls, which might have allowed direct flow of untreated effluent to discharge. Basin 1 was removed as part of the NJDEP UST removal actions conducted in spring and summer 1999.

Based on the NJDEP RI, the wastewater from the site was discharged to the CCMUA sanitary sewer system. The CCMUA permit required the pH of the wastewater to be measured prior to discharge. pH is defined as the negative log of the activity of the hydrogen ion, and is a measurement of the hydrogen ion activity in solution. The pH provides a measure on a scale from 0-14 of the acidity or alkalinity of a solution (7 being neutral, less than 7 is acidic, and greater than 7 is alkaline). The CCMUA permit mandated a pH of 6 to 9. However, the discharge from the facility's operations was 12 to 14. Therefore, a pH adjustment, or neutralization, from 12 to 14, to the pH range from 6 to 9 was required.

Basins 2 and 3 were reportedly connected via pipeline and drained liquids primarily from the "open lid" drum reconditioning area of the former facility. Dye tests, conducted by NJDEP, from the outfalls of these basins did not indicate any connection to the CCMUA

storm/sanitary sewer system as reported by facility operators. Therefore, it appears that the effluent may have been discharged directly to the subsurface. NJDEP reportedly sealed both Basins 2 and 3 with concrete.

Basin 4 was located east of the Rhodes building and was verified, via dye testing, to have received influent from the floor drains. The construction of Basin 4 was similar to Basin 1. The outfall of Basin 4 discharged to the CCMUA storm/sanitary sewer system and was permitted under CCMUA Permit No. 3412-Ca-5. The EPA removed Basin 4 in the winter of 1999.

In accordance with Community Right-to-Know Survey data collected in 1988, 1989, 1990 and 1993; the following substances were warehoused and used during drum reconditioning procedures: paint, lacquers, etc. (containing any or all of the following—isopropanol, toluene, methyl propyl ketone, naphthalene, and mineral spirits), No. 2 fuel oil, toluene, sodium hydroxide, hydrogen chloride, oxygen, acetylene, diethylaminoethanol, potassium hydroxide, No. 1 fuel oil, sulfuric acid, and kerosene.

2.3.1 Regulatory History

Beginning in 1972, NJDEP and EPA issued numerous Notices of Violation (NOVs), Administrative Orders and Penalty Assessments, Complaints, Hearing Notices, and Directives against Martin Aaron Inc. and Drum Services of Camden Inc. The identified violations included unpermitted discharges of hazardous waste, non-notification of spills or releases, improper storage of waste drums, improper waste handling and disposal, improper labeling of hazardous waste containers, hazardous waste storage violations, and others.

In May 1997, NJDEP initiated an RI/FS to determine the nature and extent of contamination and health risks associated with contamination from Martin Aaron. The Site was placed on the National Priorities List in 1999, while the RI/FS activities were underway. Upon completion of the NJDEP's RI/FS in June of 2000, the EPA became the lead agency for the Martin Aaron Site.

2.4 Previous Investigations and Remedial Activities

As discussed in Section 2.0, numerous investigations were conducted by the NJDEP prior to EPA taking the lead in the Site's investigation and remediation. This section provides a description of each historical investigation and a summary of the findings.

2.4.1 Miscellaneous NJDEP Investigations (1986–1993)

On January 3, 1986, NJDEP collected one effluent sample (sludge) from the property's drainage system. The sampling results confirmed the presence of VOCs and metals in excess of the applicable NJDEP criteria.

On January 9, 1986, NJDEP collected one liquid and one sludge sample from the concrete drainage basin located adjacent to South Broadway and one soil sample from the northwestern corner of the property. The sampling results confirmed that VOCs and metals were present in the liquid and sludge collected from the drainage basin.

On February 13, 1986, NJDEP collected one sludge sample from the basin located outside the drum wash area. The sampling results confirmed the presence of metals and total petroleum hydrocarbon at levels exceeding the applicable NJDEP criteria.

Between January 4 and 29, 1987, NJDEP, under a search warrant issued by the New Jersey Department of Law and Public Safety—Division of Criminal Justice, collected samples from buried drums exposed in test pits, sludge from sewer basins, soils, and effluent samples. The results identified the presence of hazardous waste in drums and elevated levels of metals in soil above appropriate NJDEP criteria. Sludge and effluent samples from sewer basins contained elevated VOCs and metals.

On May 13, 1993, NJDEP collected samples from drums, and roll-off containers. The sample results also showed elevated levels of VOCs and metals.

2.4.2 NJDEP Remedial Investigation

Between May 1997 and March 2000, L. Robert Kimball and Associates, Inc. conducted three phases of a RI for NJDEP. The RI was conducted to investigate the presence of soil and groundwater contamination at the Site. Investigation activities included Site mapping, a geophysical investigation to identify buried drums, and a stability investigation of the Martin Aaron building. Environmental sampling of soil and groundwater was conducted in and around potential contaminant source areas, and areas that could have been affected by contaminant migration. Investigations were conducted at Martin Aaron, and the surrounding area, and SJPC. A description of each investigation phase and the findings are presented below.

2.4.2.1 Phase I

The Phase I Investigation was conducted from May to September 1997. The Phase I sampling was conducted in and around potential contaminant source and disposal areas, and those impacted by contaminant migration. Sampling was biased, based upon previous investigation results, geophysical investigation results, visible indicators, environmental conditions, field instrument measurements, sensory characteristics, and the location and nature of potential receptors. Soil borings and excavations, sampling from monitoring wells and direct-grab sampling techniques were utilized to collect samples.

Surface and subsurface soil samples were collected from approximately 85 boring locations including inside and outside of buildings on the property, UST areas, test pit/trench excavations, and monitoring wells at and surrounding the property. Additionally, two rounds of groundwater samples were collected from seven new monitoring wells and the City of Camden Well 7. Sediment samples were also collected from Sewer Basins 1 and 4. Hydropunch groundwater samples were collected from 12 boring locations on the property.

Soil and groundwater samples were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, and Target Analyte List (TAL) metals and cyanide, and pesticides/PCBs. Sediment collected from Sewer Basins 1 and 4 were also analyzed for TCL VOCs, TCL SVOCs, and TAL metals and cyanide, and TCL pesticides/PCBs. The groundwater samples collected using the hydropunch® sampler were analyzed for TCL VOCs only.

2.4.2.2 Phase II

The Phase II Investigation was conducted from September to November 1998. The sampling was conducted both at Martin Aaron, the surrounding properties, and SJPC to delineate the nature and extent of soil and groundwater contamination identified in the Phase I Investigation. When possible, sampling was biased towards adjacent properties and property boundaries, and previously identified "hot spots." Hot spots are distinct areas where constituent concentrations exceed NJDEP soil cleanup criteria.

Soil samples were collected from approximately 60 boring locations, at Martin Aaron, the surrounding properties, and SJPC. One round of groundwater samples were collected from the seven existing monitoring wells installed as part of the Phase I Investigation, and seven new wells installed as part of the Phase II Investigation.

Soil and groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals and cyanide, and TCL pesticides/PCBs.

2.4.2.3 Phase III

The Phase III Investigation was conducted from December 1999 to March 2000. Its sampling concentrated on "hot spots" in soil identified during the earlier phases in order to delineate the horizontal and vertical extent of contamination, and provide volume estimates for contaminated soil. The sampling focused on and near previously identified "hot spots" and surrounding, and beneath, the former Rhodes Drum Building.

Soil samples were collected from approximately forty boring locations including previously identified pesticide/PCB areas, SVOC areas, and the Rhodes Drum Building area. Two rounds of groundwater samples were collected from eleven existing monitoring wells, and two installed as part of the Phase III Investigation.

Soil and groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals and cyanide, and TCL pesticides/PCBs.

2.4.2.4 NJDEP RI Results

The NJDEP Phase I, II and III investigation results are provided below for each medium of concern.

Soil. Near surface and subsurface soil contamination is widespread throughout the Martin Aaron property and extends beyond property lines. Contaminant parameters detected above NJDEP soil cleanup criteria included chlorinated and aromatic VOCs as well as SVOCs, consisting mostly of PAHs, metals, and pesticides/PCBs.

VOCs were widespread across the Martin Aaron property and extended beyond property lines to the northeast, east, and possibly to the southeast. Seventeen VOCs were detected in surface or subsurface soil collected from the property at concentrations in excess of at least one of the three NJDEP soil cleanup criteria. VOCs of concern included 1,2-dichloroethane (DCA), 1,2-dichloroethene (DCE) (total), 1,2-dichloropropane, benzene, styrene, tetrachloroethene (PCE), toluene, trichloroethene (TCE), vinyl chloride and xylene (total). These compounds were found in surface or subsurface soil at concentrations above the NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC). VOCs detected at concentrations in excess of the NJDEP Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) include 1,2-DCA,

1,2-dichloropropane, benzene, PCE, toluene, TCE, vinyl chloride, and xylene (total). In general, VOCs concentrations in soil were found to decrease with depth across the property. However, the frequency of occurrence and number of detected compounds generally increased with depth.

SVOCs were also widespread across the property and extended north, east, southeast, and west. SVOCs were detected in surface or subsurface soil at concentrations above one or more of the three NJDEP soil cleanup criteria. These included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene and naphthalene. These compounds were detected at concentrations above the RDCSCC. Each of these nine compounds, excluding naphthalene, was also detected above the NRDCSCC. Five compounds (acenaphthalene, benzo(b)fluoranthene, fluoranthene, naphthalene, and pyrene) were detected at concentrations above the NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC).

Metals contamination was found to be widespread extending beyond the property boundaries north, south, east, southeast, and west. Metals detected in Site surface or subsurface soil at concentrations above the RDCSCC included arsenic, barium, cadmium, lead, antimony, beryllium, and chromium. Metals including arsenic, beryllium, cadmium, chromium, copper, lead, thallium, and zinc were found in surface and subsurface soil in excess of the NRDCSCC. Based on the Phase I-III sampling, the horizontal extent of metals contamination possibly emanating from the property had not been delineated to the west, north, east, south or southeast. Results indicated that the metal contamination may be associated with the Site fill (consisting of combustion byproducts, ash, and cinders) observed in soil borings and test pits across the property. This scenario is supported by the apparent lack of metals contamination other than arsenic at concentrations above NJDEP soil cleanup criteria in soil beneath the southern portions of the former Martin Aaron Building. Except for a few outlying compounds (barium and beryllium), contamination observed beneath the former Martin Aaron Building generally consisted of arsenic, while beneath the yard areas north of the building consisted of a range of metals including arsenic, barium, cadmium, lead, antimony, beryllium, and chromium. The apparent lack of contamination other than arsenic, beneath the building and the similarity of the distribution of the other compounds may indicate that the metals are associated with the fill material.

Pesticide contamination, relative to the SVOCs and VOCs described above, appeared to be less widespread. Four pesticide compounds were detected in surface or subsurface soil at concentrations above the IGWSCC, RDCSCC, or NRDCSCC. Pesticide compounds of concern included aldrin, dieldrin, and heptachlor found in surface and subsurface soil at concentrations above the NRDCSCC. No pesticide compounds were detected at concentrations above IGWSCC.

Total PCB contamination within the surface and subsurface soil extended across the property. The horizontal extent of contamination is similar to that described above for the pesticide contamination. Total PCB contamination above the RDCSCC extended from beneath the former processing areas of the former Martin Aaron Building to the northern property line, to the eastern, northeastern, and southeastern property lines. Results indicated that total PCB contamination in excess of the RDCSCC extended across the east and northeast property boundaries in surface soil. Delineation of total PCB contamination

above the RDCSCC across the southern property line of the former Rhodes building could not be accomplished due to inability to sample on the adjacent property. However, the Phase III soil borings advanced southeast of the property along Sixth Street did not contain total PCBs above NJDEP soil cleanup criteria.

Groundwater. Groundwater contamination was detected in both shallow (water table) and deep monitoring wells installed at the property. Based on Phase I-III sampling results, groundwater contamination appears to be more prevalent in the shallow zone near the water table relative to deeper zones of the aquifer. Contaminant parameters detected in the shallow groundwater at concentrations above New Jersey Groundwater Quality Criteria (NJ GWQC) included chlorinated and aromatic VOCs, SVOCs, pesticides/PCBs, and metals. Contaminant parameters detected in the deeper groundwater include chlorinated hydrocarbons, SVOCs, and metals with much fewer compounds and analytes at concentrations above the NJ GWQC. The specific constituents of concern are described below.

VOC contamination within the shallow portion of the aquifer consists of a combination of aromatic compounds (benzene and xylene) and chlorinated hydrocarbons (PCE and TCE, and 1,2-DCE) and is present to at least the western, eastern, and southern property boundaries. Only one VOC (PCE) was identified in the deeper groundwater samples at a concentration above the NJ GWQC.

2.4.2.5 Areas of Concern

During the RI, several Areas of Concern (AOCs) were identified and documented in the NJDEP Final RI Report for the Martin Aaron Site (October 2000).

Buried Wastes. Anonymous reports and those by former Martin Aaron employees, received by NJDEP, indicated that between 200 and 1,000 drums of containerized wastes were buried on the property. In January 1987, a search warrant was issued by the New Jersey Department of Law and Public Safety, Division of Criminal Justice. NJDEP collected samples from on-site drums, buried drums exposed in test pits, surrounding soil, and sewer basin effluent samples. Geophysical surveys were conducted and test pits were excavated during this investigation. Geophysical surveys identified several areas of possible disposal of drums and other debris. Test pits encountered fill consisting of ash, cinders, brick, concrete, scrap metal, etc. at all excavation locations. Subsurface disposal areas were confirmed at test pit locations in the north central portion of the site, in the northeast portion of the property, and near the western property border. Subsequent activities conducted by NJDEP's UST Removal Program resulted in the discovery of some drums buried in the south central portion of the site. However, the results of the test pit excavation activities did not confirm the presence of the 200-1000 buried drums at the site.

Roll-Off Containers. Inspections conducted by the EPA (1981) and NJDEP (1983) determined that roll-off containers used for hazardous waste storage had leaked onto the soil, and two tractor trailers, each containing 100 drums, were staged alongside the facility. A second inspection conducted by EPA (1993) identified leaking drums and fumes inside the trailers. Additionally, drums stored within the yard area were observed to contain holes or were stored upside down, allowing contents to leak onto the ground.

Sewer Basins/Floor Drains. Extensive investigations, including dye-testing of Sewer Basins 2 and 3, did not locate any outfall structure. It is assumed that effluent from the former Wadco/Martin Aaron operations was discharged directly to the subsurface by infiltration. Additionally, the discharge pipe located in the influent side of Sewer Basin 1 was observed to allow untreated effluent to discharge prior to pH adjustment. Floor drains in the Martin Aaron Building led to Sewer Basins 1, 2, and 3.

Storage Tanks. Seven ASTs, five metal and two polyethylene, were located in the process area near the Rhodes Drum Building. The metal tanks were severely corroded. Concrete containment dikes surrounded the five metal tanks and the remaining area was covered by concrete pavement. Stormwater was collected throughout this area and within the containment dikes. An oily sheen was observed on the standing water surrounding the area within the dikes. Fill pipes leading to three USTs near the former Martin Aaron Building were located in this area. Discharges to surface runoff, Site soils, and groundwater were suspected from the storage tanks and their appurtenances.

Building Operations. The process buildings and storage areas are assumed to have been affected due to historic operations in these areas. Contaminants, paint residues, and wastewater could possibly have been discharged to the soil through cracks in the building floors and floor drains. In the soil, these contaminants represented a potential source of contamination to the shallow groundwater.

2.4.3 Summary of Remedial Activities

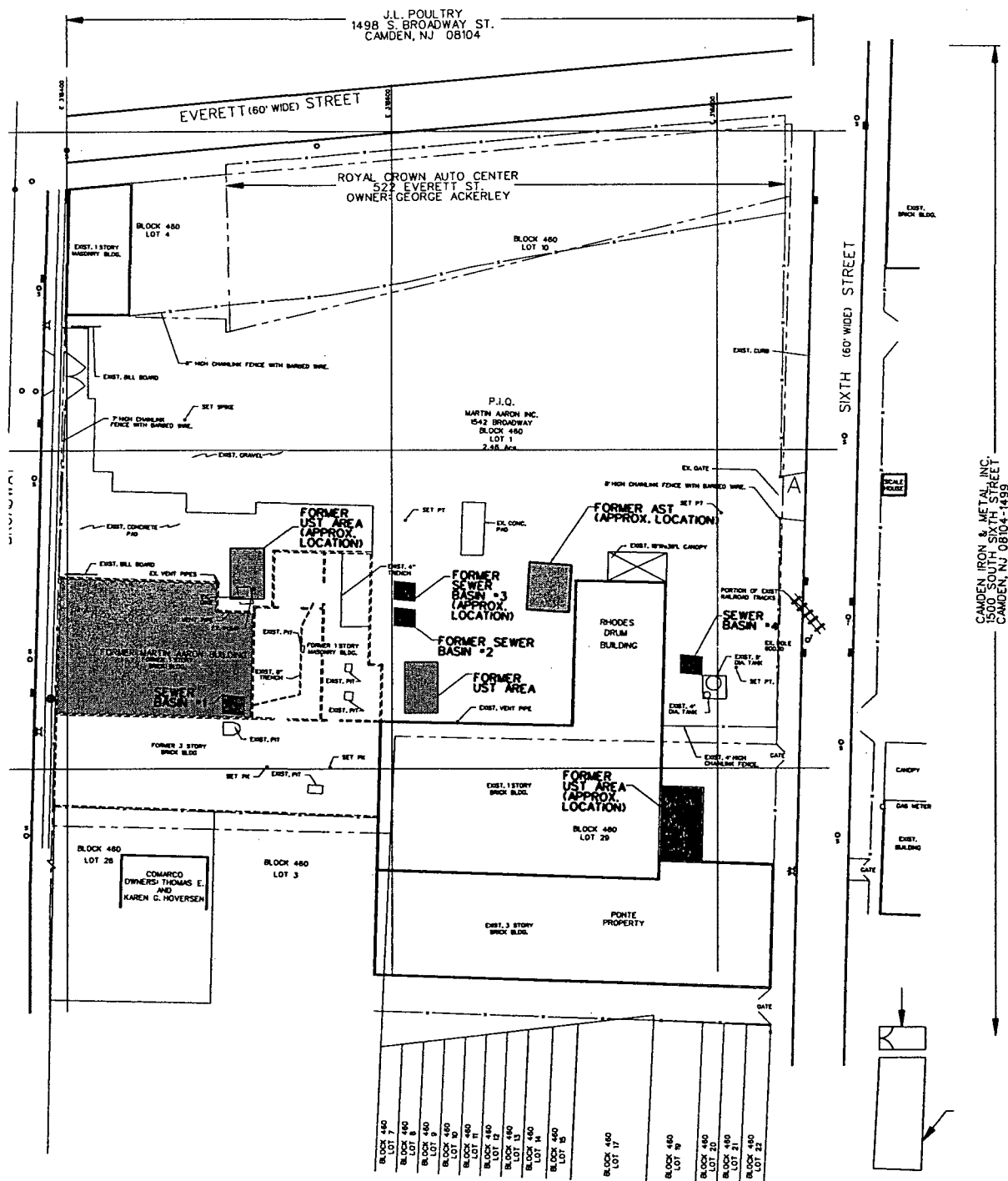
Based on the results of the investigations conducted between 1986 and 1998, immediate actions were taken to prevent risk of exposure to contamination from Martin Aaron's drum recycling operations. The following remedial actions are documented in the NJDEP RI Report;

- In 1987, the NJDEP ordered Martin Aaron, Inc. to remove contaminated soil and drums excavated from a test pit located north of the Rhodes drum building;
- In 1988, the aboveground portions of the former Martin Aaron building were demolished by the City of Camden;
- In 1999, EPA and NJDEP in a collaborative effort, removed underground storage tanks, Basin 1, Basin 4, aboveground storage tanks, and piping associated with the former Rhodes operations. Surface and subsurface soil associated with the Structures was also removed; and
- In 2000, EPA and NJDEP stabilized the property by removing drums, process equipment, tanks and contaminated soil. The property was fenced to prevent trespassing onto areas of soil contamination.

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50 0 50 100
SCALE IN FEET



LEGEND:

- CATCH BASIN
- SEWER MANHOLE
- TELEPHONE MANHOLE
- UNKNOWN MANHOLE
- WATER MANHOLE
- EXISTING POLE
- HYDRANT

NOTE:

UST - UNDERGROUND STORAGE TANK
AST - ABOVEGROUND STORAGE TANK

FIGURE 2-1

MARTIN AARON SITE BASE MAP (EAST)

MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

CH2MHILL

301898

3. Description of Remedial Investigation Activities

To further identify the horizontal and vertical extent of soil and groundwater contamination at the Site, CH2M HILL conducted remedial investigations on behalf of the EPA.

Investigation activities include collection and analysis of surface and subsurface soil samples, installation and sampling of groundwater monitoring wells, and hydrologic testing. Remedial investigation activities were conducted in accordance with the Field Sampling Plan, dated September 2001, which is provided in Appendix A.

3.1 Soil Investigation

3.1.1 Surface Geophysical Surveys

Site utility clearance was accomplished by contacting New Jersey One Call and conducting surface geophysical surveys. New Jersey One Call coordinated with all local utilities and marked out all known active subsurface utilities. The purpose of the surveys was to gather information to identify unknown utilities and subsurface objects prior to drilling activities. The results of the surface geophysical surveys were used to modify the placement of some boring and monitoring well locations to avoid unknown subsurface anomalies or provide a safer distance from detected subsurface utilities. A copy of the geophysical survey is provided in Appendix B.

Surface geophysical surveys were conducted in two phases. Phase I consisted of scanning the entire Site to identify and trace both known and unknown subsurface utilities and structures. Phase II consisted of a more-detailed scan of 10-ft squares centered on proposed sampling and monitoring well locations. Surveys involved the use of three electromagnetic methods: electromagnetics, ground-penetrating radar (GPR), and magnetometer. Envirosan, Inc. performed the surveys on August 21 and December 5, 2001.

The electromagnetic survey was conducted using several pieces of equipment. The first scan was conducted using a Fisher TW-6 pipe and cable locator and tracer. This instrument can reportedly detect a 2-inch-diameter metal pipe to a depth of 8 ft and a 10-inch-diameter metal pipe to a depth of 14 ft. The second scan was conducted using a Radiodetection Cable Avoidance Tool (C.A.T.) and Genny pipe and cable locator and tracer. Both the TW-6 and C.A.T. are handheld devices used to scan the entire Site. A third piece of equipment, a Geonics EM-61 metal detector, was also used for the electromagnetic scan. This device is mounted on a small trailer that is walked around the Site. The EM-61 can reportedly detect a 55-gallon steel drum 12 ft deep or larger objects at greater depths.

The GPR survey was conducted using a GSSI SIR-2 GPR, which is used to detect nonmetallic or metallic subsurface utilities and structures. The GPR is traversed across the surface and the subsurface. Images of the traverse are then viewed on a color display. The

results can be viewed instantaneously in the field and then processed using complex algorithms for examination in greater detail in the office.

The magnetometer survey was conducted using a Fisher FX-3 MAG. This device can reportedly detect a 2-inch steel pipe 4 ft deep and a buried manhole cover 10 ft deep.

3.1.1.1 Results of Surface Geophysical Survey

A C.A.T. survey in both Power and Radio modes was used to delineate any sort of live power, gas, or water utilities that crossed the Site. No power anomalies were detected across the entire survey area. Several radio anomalies were noted surrounding two buildings within the southern portion of SJPC. The limits of these anomalies were marked on the ground surface and are included in Figures 1 and 2 of Appendix B. These anomalies did not terminate at any surficial utility and could not be positively identified with the C.A.T. The TW-6 pipe and cable locator and tracer were used in induction mode to trace and positively identify these anomalies. One line east of the Rhodes Drum Building was traced to a water-valve cover along Broadway. Two additional lines were traced to small junction boxes on the buildings. It could not be determined if either of these two lines were active or not. Several other anomalies could not be further identified. All of the anomalies identified by the C.A.T and TW-6 are shown on Figure 1 and 2 of Appendix B.

The EM-61 survey detected two anomalies on the Site. Both anomalies corresponded to buried reinforced concrete pads. Several linear zones of increased metal content were detected on the SJPC. These anomalies could represent buried metal piping or inactive utilities. It should be noted that these features were not detected by any instruments sensitive to utilities. Adjacent to these linear anomalies are two large clusters that display low levels of metal content. No subsurface utilities were detected in either of these areas, thus borings located in these areas (SB-68 and SB-29) were not moved. Extra care was taken advancing borings in areas with apparent elevated metal content.

Each individual sample location was cleared (in a 10-ft-diameter area) using a C.A.T. in Power and Radio modes, a TW-6 in metal detection mode, a FX-3 and GPR.

Anomalies detected were marked on the ground surface and recorded in the field logbook. Soil boring locations SB-66, SO-206, and monitoring well MW-21S, were moved from their proposed locations due to the presence of unidentifiable subsurface anomalies.

3.1.2 Surface Soil Sampling

Surface soil samples were collected at 60 locations identified on Figure 3-1. The samples were collected to 2 ft below grade. The goal was to collect the upper 6 inches of soil, but the upper 6 inches of material consisted mainly of asphalt and/or concrete at several sampling locations. Therefore, at these locations, the sample was collected from the soil immediately beneath the concrete or asphalt material. Surface soil samples were collected using direct-push techniques and an acetate sleeve lined macro-core sampler. In certain locations, due to equipment access issues, soil sampling was conducted using a hand auger. Surface soil samples at monitoring well locations were collected from split spoon samplers.

The soil cores were logged and examined for visual evidence of contamination and field screened. At the Welsbach Superfund Site within the City of Camden, soil with high levels

of radioactive thorium have been identified. As a result, a radiation detector was used to screen the soil for elevated readings at the Site. The radiation detector was calibrated according to manufacturer's specifications. There were no readings measured during any of the field activities for the RI that exceeded ambient, or background, levels of radiation. A Photoionization Detector (PID) was used to screen for organic soil vapors that may indicate the presence of contaminants. Field observations and measurements were recorded in the field logbook and soil boring data sheets.

The samples were collected by first driving the split spoon into the soil for samples collected from monitoring well borings or driving a macro-core sampler at soil boring locations. Samples to be analyzed for VOCs were collected from the upper 2 ft of material collected in the split spoon or macro-core using EnCore™ samplers. The remaining soil was placed in a clean bowl or pan and homogenized before filling the appropriate sample containers to be analyzed for SVOCs, metals, and pesticides/PCBs.

An EPA Region II CLP laboratory analyzed the surface soil samples for TCL VOCs, SVOCs, and pesticides/PCBs, and TAL Metals.

3.1.2.1 Surface Soil Sampling Equipment Decontamination

To prevent cross contamination between samples, non-dedicated sampling equipment was thoroughly cleaned before each use by the EPA -approved "triple rinse" method, which consists of a series of solvent washes and distilled and potable water rinses arranged in the following sequence:

- Wash and scrub with nonphosphate detergent
- Tap water rinse
- Distilled/deionized water rinse
- Ten-percent nitric acid rinse
- Distilled/deionized water rinse
- Acetone rinse
- Rinse with deionized water
- Air dry
- Wrap in aluminum foil, shiny-side out.

3.1.3 Subsurface Soil Sampling

3.1.3.1 Unsaturated Soils

Subsurface, unsaturated soil samples were collected at depths ranging from 2 to approximately 21 ft below ground surface (bgs) during borehole advancement and during drilling of the shallow groundwater monitoring wells. Soil boring locations are shown in Figure 3-1. The soils were field screened using a PID and radiation detector from below the depth of the surface soil sample to the top of the groundwater table using direct-push techniques and split spoon-sampling techniques. Soils were described by a CH2M HILL geologist in accordance with the Unified Soil Classification System (USCS; ASTM 422). Subsurface samples submitted for analysis were selected from the highest PID reading or the sample collected at the soil/groundwater interface if no elevated PID readings were detected. Similar to the surface soil samples, no radiation readings were measured during any of the field activities for the RI that exceeded ambient, or background levels. Soil

samples for VOC analysis were collected using an EnCore sampler. The remaining sample fraction was homogenized in clean bowls before filling the appropriate sample containers.

An EPA Region II CLP laboratory analyzed the subsurface, unsaturated soil samples for TCL VOCs, SVOCs, and pesticides/PCBs, and TAL Metals.

3.1.3.2 Saturated Soils

Subsurface, saturated soil samples were collected at 24 locations during drilling for the shallow, intermediate, regional and deep monitoring wells. The sampling locations are shown in Figure 3-1. These soil samples were submitted for analysis of total organic carbon (TOC), porosity, moisture content, pH, grain size and bulk density. Saturated soil samples were not analyzed for CLP parameters. Soils below the water table were collected continuously at 2-ft intervals from the ground surface to the total depth of the boring using 2-inch-diameter, 2-foot long split-spoon samplers advanced with a 140-lb hammer, with a 30-inch drop. The retrieved soil sample was logged, and field screened by the onsite geologist or engineer. Fifteen samples of saturated soils were collected to assess lithologic and geotechnical characteristics of the subsurface soil. Four soil samples were collected from the shallow zone (15-20 ft bgs). Seven soil samples were collected from the base of the Upper PRM Aquifer (55-65 ft bgs). Four soil samples were collected from the clay underlying the Upper PRM Aquifer (greater than 65 ft bgs).

3.2 Groundwater Investigation

Two rounds of groundwater sampling were conducted as part of this RI. The first sampling event occurred from June 12 to June 28, 2002 and the second sampling event was conducted from September 17 to September 25, 2002.

3.2.1 Evaluation of Existing Monitoring Wells

Prior to the start of groundwater sampling activities, the previously installed monitoring wells were located and evaluated to determine whether they could be sampled as part of the groundwater sampling program. Of the thirteen known existing monitoring wells, ten were located. The remaining three monitoring wells (MW-2S, MW-2M and MW-6S) could not be located visually, by scaling off of existing maps, or using geophysical methods.

These ten wells were then evaluated to determine if the concrete pad was in good condition, if the flush mount cover was in good condition, if there was standing water in the road box, if the locking well cap was in place and intact, if the lock was in good working order, if the steel casing (if applicable) appeared to be in good condition, if the PVC well riser pipe appeared to be in good condition, and if the well depth was as noted in soil boring and/or well construction documentation.

It should be noted that several of the wells were damaged but still appeared to be in acceptable shape. MW-10S, MW-9S, MW-9D and MW-8S all had damaged concrete pads and flush mount covers. Each had a small amount of water in the road box. MW-9D had the most damage including an offset steel casing. However, all the wells appeared to be intact and were sampled as part of the June and September 2002 sampling events.

3.2.2 Drilling and Monitoring Well Installation

A total of 24 groundwater monitoring wells were installed at 11 locations on the Site, including Martin Aaron, SJPC, Comarco Products, Ponte Company, the scrapyard, and well locations on Everett Street and Sixth Street, to evaluate hydrogeologic conditions and groundwater quality. As shown on Figure 3-2, a total of 34 new and existing wells were sampled as part of this RI. The main aquifer system beneath the Site is known as the Potomac-Raritan-Magothy (PRM) Aquifer system and is discussed further in Section 4 of this RI. In the Camden area, the PRM Aquifer system contains three thick sand units, which are designated as the Upper, Middle, and Lower PRM Aquifers. At the Site, well borings penetrated through the Upper PRM Aquifer into the Middle PRM Aquifer.

During the drilling activities it was determined that the Upper PRM Aquifer contains thin clay stringers that were misidentified during the NJDEP RI as the regional clay confining layer (Kimbell, 2000). As a result, the "intermediate" monitoring wells were installed near the middle of the Upper PRM Aquifer rather than the base as described below. Additional monitoring wells were installed and referred to as "regional" wells which were placed near the bottom of the Upper PRM Aquifer.

The 24 newly installed monitoring wells consisted of 11 "shallow" wells completed near the top of the Upper PRM Aquifer, 7 "intermediate" wells completed near the middle of the Upper PRM Aquifer, 3 "regional" wells completed near the bottom of the Upper PRM Aquifer, and 3 "deep" wells completed in the Middle PRM Aquifer. The wells were designated as "S" for shallow, "M" for intermediate, "R" for regional, and "D" for deep. The total included one 4-well nest (shallow, regional, intermediate and deep wells identified as MW-20S/MW-20M/MW-20R/MW-20D), three 3-well nests (shallow, intermediate or regional and regional or deep wells identified as MW-14S/MW-14R/MW-14D, MW-18S/MW-18M/MW-18D, and MW-19S/MW-19M/MW-19R), four 2-well nests (shallow and intermediate wells identified as MW-12S/MW-12M, MW-13S/MW-13M, MW-15S/MW-15M, and MW-17S/MW-17M) and 3 single shallow wells (identified as MW-16S, MW-21S and MW-22S). MW-20R, MW-14R, and MW-20D are installed in a sand unit that lies in the composite confining bed between the Upper and Middle PRM Aquifers.

Underground utilities and other potential subsurface hazards were cleared at each drilling location prior to initiating drilling. These clearances include contacting NJ One Call and an evaluation of the proposed boring locations by a geophysical subcontractor. Additionally, all necessary permits, including NJDEP monitoring well and soil boring permits, were secured prior to commencement of field activities.

The shallow, intermediate, regional, and deep wells were constructed of 2-inch-diameter PVC casing and well screen with flush-threaded joints. The well screens were 10 ft long and had a slot size opening of 0.010 inches (10-slot screen). The casings, screens, and fittings were factory-sealed prior to installation.

The well screens were filter-packed with appropriately sized, graded, washed, and well-rounded siliceous sand. The filter pack extended 6 inches below the base of the screen to a minimum of 2 ft above the top of the screen. If depth permitted, 2-ft choker sand was placed above the filter pack to inhibit migration of annular seal material into the filter pack. The depth of the filter pack was measured using a weighted tape. The remaining annular space was filled to grade with a bentonite-cement/slurry-grout mixture by tremie method

for the deep, regional, and intermediate wells. For the shallow wells, the annular space was filled by manually placing the bentonite grout through the hollow stem augers into the open borehole. After settling overnight, additional grout was added to the borehole to maintain grade.

A waterproof, keyed-alike locking cap capped each well. A protective-steel, flush-mounted "road box" outer casing was installed around the riser pipe at the ground surface. The protective outer casing was at least 12 inches in diameter, and was set into a cement collar after the monitoring well grout seal had set up. A layer of sand (approximately 6 inches to 1 ft thick) was placed at the base of the road box to allow for drainage of water that does enter the box. The cement collar was sloped away from the well to promote drainage. The well identification number was steel-stamped onto the outer protective steel casing.

3.2.2.1 Shallow Monitoring Wells

Eleven shallow monitoring wells were installed between October 2001 and May 2002 using 6.25-inch-inside-diameter (ID) hollow-stem augers. The borings were advanced to a depth just below the first encountered groundwater with the well screens set to straddle the surficial groundwater table. Well depths ranged from 15.0 to 21.0 ft bgs. The soil samples collected during drilling were logged and field screened using a PID and radiation detector. Soil descriptions, field measurements, samples collected, and other observations were recorded in the field logbook. In addition, drilling log forms were completed for each boring by the field engineer. Table 3.2-1 lists the shallow monitoring wells, boring depths and screened intervals. Well construction diagrams for these wells are provided in Appendix C.

TABLE 3.2-1
Shallow Monitoring Wells
Boring Depths and Screened Intervals

Monitoring Well ID	Boring Depth (ft. bgs)	Screened Interval (ft. bgs)
MW-12S	15.4	5.4–15.4
MW-13S	16.6	6.6–16.6
MW-14S	17.0	7.0–17.0
MW-15S	16.8	6.8–16.8
MW-16S	16.5	6.5–16.5
MW-17S	18.0	8.0–18.0
MW-18S	17.8	7.8–17.8
MW-19S	15.0	5.0–15.0
MW-20S	17.9	7.9–17.9
MW-21S	21.0	11.0–21.0
MW-22S	21.0	11.0–21.0

3.2.2.2 Intermediate Monitoring Wells

Seven intermediate monitoring wells were installed in the central portion of the Upper PRM Aquifer between October 2001 and May 2002 using mud rotary methods. Well depths ranged from 41.7 to 69.4 ft bgs. Well borings were continuously sampled in 2-ft intervals, logged, and field screened using a PID and radiation detector until the desired well depth, as determined by the field engineer, was achieved. Soil descriptions, field measurements, samples collected, and other observations were recorded in the field logbook. In addition, drilling log forms were completed for each boring by the field engineer. Table 3.2-2 lists the intermediate monitoring wells, boring depths and screened intervals. Well construction diagrams for these wells are provided in Appendix C.

TABLE 3.2-2
Intermediate Monitoring Wells
Boring Depths and Screened Intervals

Monitoring Well ID	Boring Depth (ft. bgs)	Screened Interval (ft. bgs)
MW-12M	48.1	38.1–48.1
MW-13M	58.4	48.4–58.4
MW-15M	69.4	59.4–69.4
MW-17M	51.8	41.8–51.8
MW-18M	41.7	31.7–41.7
MW-19M	52.0	42.0–52.0
MW-20M	52.0	42.0–52.0

3.2.2.3 Regional Monitoring Wells

Four “regional” monitoring wells were installed at the base of the Upper PRM Aquifer, or in the composite confining bed separating the Upper and Middle PRM Aquifers, between October 2001 and May 2002 using mud rotary techniques. Previous investigations conducted at the Site including the NJDEP RI indicated that the confining layer separating the Upper and Middle PRM Aquifers occurred between 55 and 65 ft bgs. Based on this information it was proposed that the “intermediate” monitoring wells would be located at the base of the Upper PRM. During the drilling it became evident that small, discontinuous stringers of clay transected the Upper PRM Aquifer. The interbedded lithology made identifying the clay confining bed between the Upper and Middle PRM Aquifers difficult. As a result of this new information, the seven “intermediate” monitoring wells were set near the mid-point of the Upper PRM and three “regional” monitoring wells were added that were set at the base of the Upper PRM Aquifer. Well depths for the regional wells ranged from 113.0 to 133.0 ft bgs. Well construction diagrams for these wells are provided in Appendix C.

The continuously collected soil samples from each boring were logged and field screened using a PID and radiation detector continuously until the desired well depth, as determined by the field engineer, was achieved. Soil descriptions, field measurements, samples collected, and other observations were recorded in the field logbook. In addition, drilling

log forms were completed for each boring by the field engineer. Table 3.2-3 lists the "regional" Upper PRM Aquifer monitoring wells, boring depths and screened intervals.

TABLE 3.2-3
Regional Monitoring Wells
Boring Depths and Screened Intervals

Monitoring Well ID	Boring Depth (ft. bgs)	Screened Interval (ft. bgs)
MW-14R	119.5	109.5–119.5
MW-19R	113.0	103.0–113.0
MW-20R	123.0	113.0–123.0

3.2.2.4 Deep Monitoring Wells

Three deep wells were installed below the confining unit separating the Upper and Middle PRM Aquifers between October and May 2002 using mud rotary techniques. Well depths ranged from 133 to 188 ft bgs. The deep wells were installed following completion of the adjacent intermediate wells such that the depth to the confining unit was known. The deep wells were double-cased to prevent the potential for cross-contamination between the Upper and Middle Aquifers.

The uppermost zone (from ground surface to the confining layer) was drilled without sampling using mud rotary methods. The borehole diameter through the upper zone was nominal 10 inches to allow installation of a 6-inch-diameter steel isolation casing. Prior to installing the casing, a 1-ft bentonite seal was placed in the annulus at the bottom of the borehole. The bentonite seal consisted of hydrated bentonite chips that were pumped through a tremie pipe to the bottom of the open borehole. A 6-inch-diameter steel casing was lowered inside the open borehole, seated into the clay layer. The annular space around the casing was filled with a cement/bentonite seal to the ground surface. Drilling of the deep wells was then conducted through the permanent casing to a depth of approximately 15 ft below the bottom of the confining clay layer using a nominal 6-inch-diameter drill bit. A 2-inch-diameter, schedule 40 PVC monitoring well was then installed such that the screened interval, including sand filter pack, was below the bottom of the regional confining clay layer. Table 3.2-4 lists the "deep" Upper Middle PRM monitoring wells, boring depths and screened intervals. Well construction diagrams for these wells are provided in Appendix C.

TABLE 3.2-4
Deep Monitoring Wells
Boring Depths and Screened Intervals

Monitoring Well ID	Boring Depth (ft. bgs)	Screened Interval (ft. bgs)
MW-14D	188.0	178.0–188.0
MW-18D	150.0	140.0–150.0
MW-20D	133.0	123.0–133.0

3.2.3 Well Development

The new and existing monitoring wells were developed by pumping groundwater with an electric-powered submersible pump at rates ranging from 1.2 to 3.0 gallons per minute, unless purged dry. Polyethylene tubing was used as discharge pipe. New tubing was used for each well and was disposed of after use. The submersible pump intake was set at the midpoint of the well screened interval. The pump was surged to facilitate the removal of fine sediments at the bottom of the well. Measurements of water quality parameters were recorded every five minutes during well development. The water quality parameters included: pH, temperature, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity. The development water was containerized in a 55-gallon drum and transported to a central storage area. The containerized water was then pumped to a larger bulk storage tank along with other investigation-derived waste (IDW) water. The water in the storage tank was sampled and disposed of by a licensed hazardous waste disposal company.

Development of newly constructed wells began no sooner than 48 hours, but no later than 7 days, installation was completed. Development continued until either of the following conditions was met:

1. At least three well volumes (including the saturated filter material in the annulus) was removed from the well, and stabilization of water quality parameters had occurred (defined as less than 10 percent variance between the removal of two successive well volumes).
2. Five well volumes were purged, regardless of stabilization of the water quality parameters.

Development of the new wells was conducted in accordance with SOP F.2 in the Field Sampling Plan (FSP) provided in Appendix A. The well development data was recorded on Well Development Logs.

3.2.4 Water Level Surveys

Synoptic water-level measurements were collected to examine local groundwater flow directions and hydraulic gradients. Water levels were measured in the existing and new Site monitoring wells, and the City of Camden Well 7. In addition, river stage information from the Delaware River was obtained from local sources. Water level data was collected during the two events. The first round of water levels was collected between June 12 and 28, 2002, and the second round was collected between September 17 and September 25, 2002.

The depth-to-water readings were obtained using a conductivity-based electronic water level measuring device, as described in SOP F.7 in the FSP provided in Appendix A. The electronic device emits an audible signal when the probe touches the water. The depth-to-water measurement was made from a designated point on the innermost PVC riser casing.

In addition, the total depth was measured in the new and existing monitoring wells. The well depth was used to calculate the required purge volumes for sampling and assess the amount of solids present in the bottom of the wells.

3.2.5 Groundwater Sampling

3.2.5.1 Low-Flow Sampling of Monitoring Wells

All monitoring wells were sampled in accordance with the EPA Region II Low-Flow Sampling Procedures. Prior to purging and sampling, groundwater levels were measured in the wells to verify general groundwater flow directions. The low-flow sampling method was used for purging and sampling the wells. Low-flow sampling minimizes the disturbance of sediment on the bottom or sides of the well, minimizes the concentration of suspended sediment in resulting water samples, allows the water quality parameters in the discharged water to stabilize quickly, and reduces the quantity of purge water (IDW) to be containerized, treated, and disposed. Prior to sampling, the pump was lowered to the desired depth in the well. The pump intake was kept at least 2 ft above the well's bottom of the well disturbance and resuspension of any sediment or Non-Aqueous Phase Liquid (NAPL) present at the bottom of the well. The depth to which the pump was lowered and the rationale used in selecting the depth were recorded on the Low Flow Sampling Log, which is included as part of the field documentation for the RI. The discharge water from the pump was monitored for important field chemistry parameters including: pH, temperature, turbidity, oxidation-reduction potential, dissolved oxygen, and specific conductance (Table 2-1).

Pumping was continued until the field parameters stabilized. After the indicator parameters stabilize, the groundwater sample was collected as described in SOP F.4 in the FSP provided in Appendix A. Appropriate sample bottles were filled and placed in an ice filled cooler. The sampling details were recorded on the Low Flow Sampling Log.

Discharge water generated during purging and sampling activities was containerized in 55-gallon drums. Following completion of daily sampling activities the drums were emptied into a temporary storage tank and ultimately removed from the property by a licensed hazardous waste disposal company.

3.2.5.2 Camden City Well 7

The CCMUA's Well 7, located at 9th Street and Florence Avenue, approximately 3,500 feet (0.7 miles) from the property (Figure 1-1), was sampled during the same two events as the Site monitoring wells. Well 7 was purged before a sample was collected to ensure that water representative of the formation is sampled and not the water in the well casing or pipes. The amount of purging necessary was dependent on the operating status of the well.

A valve connected directly to the wellhead with the permission of City personnel and was selected to collect the sample prior to any filtration or treatment system. The sample valve was allowed to purge for five minutes or until the water ran clear. The samples were then collected from the valve following the same sampling procedures already defined for monitoring wells.

The City Well 7 is not currently in use but is used as an emergency water supply well.

3.2.5.3 Sample Analysis

The collected groundwater samples were submitted for laboratory analysis of TCL VOCs, TCL SVOCs, pesticides/PCBs, cyanide and for TAL filtered (dissolved) metals and

unfiltered (total) metals and cyanide. In addition, the groundwater samples were submitted for laboratory analysis of selected natural attenuation parameters (parameters selected from Table 2.3 of EPA's Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, 1998). The natural attenuation parameters included: alkalinity, total suspended solids (TSS), total dissolved solids (TDS), hardness, iron (total and dissolved), ferrous iron, arsenic (dissolved), ammonia, total Kjeldahl nitrogen (TKN), nitrate, nitrite, calcium, potassium, manganese, phosphorus (total), sodium, chloride, sulfate, sulfide, methane, ethane, ethene, TOC, biological oxygen demand (BOD), chemical oxygen demand (COD), and carbon dioxide.

3.2.6 Quality Assurance/Quality Control Sample Procedures

Soil and groundwater samples were submitted to the CLP laboratory designated by the EPA. CLP laboratories have internal quality assurance/quality control (QA/QC) programs to ensure the reliability and validity of the analyses being performed. QA/QC procedures were also implemented for onsite field instruments including PIDs, radiation detectors, and water quality meters. The instruments were calibrated daily as described in the SOPs. Field sampling precision and bias were evaluated by collecting field duplicates and equipment blanks for laboratory analysis.

3.2.6.1 Field Duplicates

Field duplicate samples were used to measure the heterogeneity of the sample matrix and the precision of the field sampling and analytical process. Duplicate samples were collected at a frequency of one duplicate per 20 samples or at least one duplicate per week of each analyte and sampled medium. For soils, field duplicate samples were collected by placing the soil in a stainless steel bowl, thoroughly homogenizing the soil by mixing, and filling the individual sample and duplicate containers from the bowl. Prior to homogenizing the samples, VOC samples were collected using EnCore™ samplers. The individual sample was collected first, then the duplicate as close to the individual sample as possible.

The groundwater field duplicate samples were collected by alternately filling first the sample bottle for one analysis and then the duplicate bottle for the same analysis. This procedure was followed until the bottles for analyses were filled. An inline filter was used to collect samples and duplicates for dissolved metals.

3.2.6.2 Equipment Blanks

Equipment blanks were collected and analyzed to evaluate whether the decontamination procedures had been adequately performed and that there was no cross-contamination of samples occurring due to the equipment or residual decontamination solutions. Equipment blanks were collected for soil and groundwater samples. Analyte-free distilled and deionized water was poured directly into and over decontaminated sampling equipment and then transferred to the sample containers. The samples were preserved and handled in the same manner as groundwater samples. Equipment blanks were collected at a frequency of one per 20 samples collected or once per week.

3.2.6.3 Trip Blanks

Trip blanks were used to assess if any onsite atmospheric contaminants are seeping into the sample bottles, or if any cross-contamination of samples occurred during shipment or storage of sample containers. Aqueous trip blanks were collected for both aqueous and solid samples for VOC analysis.

The trip blank consisted of analyte-free distilled and deionized water preserved with 1:1 HCL to a pH of less than or equal to 2 standard units in 40-ml septum vials. One set of trip blanks was included with each sample cooler containing one or more samples for VOC analysis.

3.2.6.4 Matrix Spike/ Matrix Spike Duplicate

The matrix spike/matrix spike duplicate (MS/MSD) samples were used by the laboratories to assess the precision and accuracy of sample analysis. Two extra sample volumes were collected for each MS/MSD sample. An MS/MSD sample was collected at a frequency of one MS/MSD per 20 samples collected or at least one per week.

3.2.6.5 Temperature Blanks

The temperature blank was prepared to allow the laboratories receiving samples to determine if the samples were received within the allowable temperature range. The temperature blanks consisted of an unpreserved sample bottle filled with deionized water. One temperature blank was included with each cooler containing samples.

3.2.7 Tidal Survey

A tidal influence study was conducted using a combination of existing and newly installed monitoring wells. The study consisted of installing pressure transducers and data loggers in five shallow wells, five intermediate wells, and two deep wells at the Site for a 120-hour period, from June 5 to 9, 2002. Hydraulic stage data from the Delaware River, and pumping well data from the City of Camden's Well 7 were obtained for the same period. Based on well depth and distribution across the project Site, the following wells were chosen for the tidal survey:

- MW-8S
- MW-15S
- MW-14R and MW-14D
- MW-18D
- MW-19S and MW-19R
- MW-20S, MW-20R, and MW-20D
- MW-21S

Study data were evaluated to assess if the water levels in the Upper and Middle PRM Aquifers beneath the Site were influenced by off-Site sources (i.e., pumping wells, and tidal fluctuations in the Delaware River). The tidal survey results are discussed in Section 4.4.4.1 and Section 4.4.4.2. The tidal survey graphs are provided in Appendix D.

3.2.8 Hydraulic Conductivity Testing

In-situ hydraulic tests (i.e., slug testing) were performed at the new and existing well locations to evaluate the hydraulic conductivity of aquifer materials. The slug test results are also provided in Appendix D. The tests consisted of monitoring the aquifer response to a sudden change in hydraulic head (increasing and decreasing) in a well bore. The head change at each well was induced by the placement of a solid polyethylene slug into the water column (falling head test), and the subsequent removal of the slug from the water column (rising head test). Pressure transducers with data loggers and water level meters were used to measure the changes in water level over time during the testing.

Prior to testing the wells, the water level was measured to assess if the water level was above or within the screened interval of the well. If the water level was above the screened interval, a falling-head slug test, followed by a rising head test, were performed. If the water level was below the top of the screened interval, then two rising-head slug tests were performed.

Slug test procedures consisted of:

- Measure the static water level in the well using an electronic water level indicator;
- Lower the pressure transducer with attached cable to within about 2 ft of the bottom of the well;
- Activate the data logger and check to see if the data logger/transducer are working correctly;
- Start the data logger and rapidly insert the slug completely below the static water level for falling head tests (or remove the slug completely for a rising head test, following stabilization of the water level from insertion of the slug), so that the change in head is essentially instantaneous;
- Intermittently measure the water levels with a water level indicator noting the time of measurement in reference to the start of the test (this will serve as a backup to the data logger);
- Monitor water levels until the levels have stabilized (i.e., water levels are within ± 0.2 ft of the static reference level, or within 80 percent of static level);
- Perform at least two tests at each location (as described above); and
- Decontaminate the slug, water level indicator and transducers between successive wells using standard decontamination procedures.

3.3 Surveying

A New Jersey licensed surveyor surveyed all soil boring locations, existing and newly installed monitoring wells and existing surface features including buildings and property lines. The vertical elevations were surveyed within ± 0.01 ft, and the horizontal locations within ± 0.1 ft. The elevations were referenced to the National Geodetic Vertical Datum (NGVD). The surveyor also completed NJDEP Groundwater Monitoring Well Certification—Well Form B for each newly constructed monitoring well. Copies of the Form B for each well are provided in Appendix E.

3.4 RI-Derived Waste Management

This task included characterizing and disposing of investigation derived waste (IDW) in accordance with local, state and federal regulations. The following types of IDW were generated from the investigation activities:

- Spent personal protective equipment (PPE), including clothing and sampling supplies
- Soil cuttings (containerized)
- Wastewater from well development, purging and decontamination activities (containerized)
- Sediment from the onsite wastewater storage tank

Spent PPE, after decontamination, was treated as debris and placed in a 10-cubic-yard dumpster along with other nonregulated trash. The dumpster was emptied regularly (approximately every 2 weeks) during the course of the investigation. PPE waste was disposed of at a non-hazardous facility according to 40 CFR. 268.45.

Soil cuttings generated from drilling and soil sampling during the fieldwork were placed into a tarped, labeled, sealed-gate roll-off container. One composite waste characterization sample was collected. The sample was sent to a CH2M HILL-subcontracted laboratory for analysis to determine the RCRA disposal characteristics as required by NJAC 7:26G-6.2 and 40 CFR 261. The composite soil sample was collected and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, SVOCs, pesticide/PCBs, and metals.

In addition, an estimated 8,000 gallons of purge, development, and decontamination water were generated over the course of the investigation. One water sample was collected and analyzed for disposal requirements. A CH2M HILL-subcontracted laboratory analyzed the water sample for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals. Additional disposal characterization parameters, including pH, ignitability, reactive sulfide, reactive cyanide, paint filter test, total solids, total volatile solids and oil and grease were conducted by an independent laboratory subcontracted by CH2M HILL. The containerized waters were disposed of by a licensed hazardous waste disposal company in accordance with Federal, State, and local regulations.

3.5 Rhodes Drum Building

A safety inspection was conducted at the Rhodes Drum Building on June 17, 2001 to evaluate possible structural deficiencies of the existing building condition and to appraise the structure's safety for specific RI field activities to occur inside the building. If the safety inspection determined that the building was structurally sound, field personnel would be allowed access inside the building to collect wipe-and-chip samples. The purpose of this sampling was to determine if residual contamination was present that could pose potential risks to human health, and/or affect the future actions for the building. The results of this inspection determined that there was poor wall support in the areas of the building which would cause risk of personal injury due to potential roof collapse. Therefore, it was

determined in order to protect worker health and safety, that samples would not be collected in the Rhodes Drum Building.

3.5.1 Description





The Rhodes Drum Building is a single-story, 54-x-88-ft-brick load-bearing wall and timber-roof truss building. The ceiling is 15 ft high at the center roof pitch running in a north-south direction. Two column lines running north-south divide the building into three equally spaced areas. Columns are spaced at 18-ft intervals to support the 13-x-10-inch beams in longitudinal direction of the building. The roof truss spacing is 9 ft spanning between the beams in the center area. The ceiling is supported by 8-x-3-ft roof joists spaced at 9-ft intervals in the east and west bay.

The load bearing walls are 16-x-4-ft adobe brick walls with 5-ft openings in between the walls. The openings are now closed in with an 8-inch brick wall. There is a 5-x-6.25-ft doorway at the south bay on both the east and west walls. The opening on the south wall connecting to the warehouse area is completely sealed by masonry units. The doorway on the north wall is 14 ft wide.

301914



Legend

-  Soil Sampling Locations
-  Martin Aaron Property Boundary
-  South Jersey Port Property Boundary
-  Structures

0 25 50 100 Feet


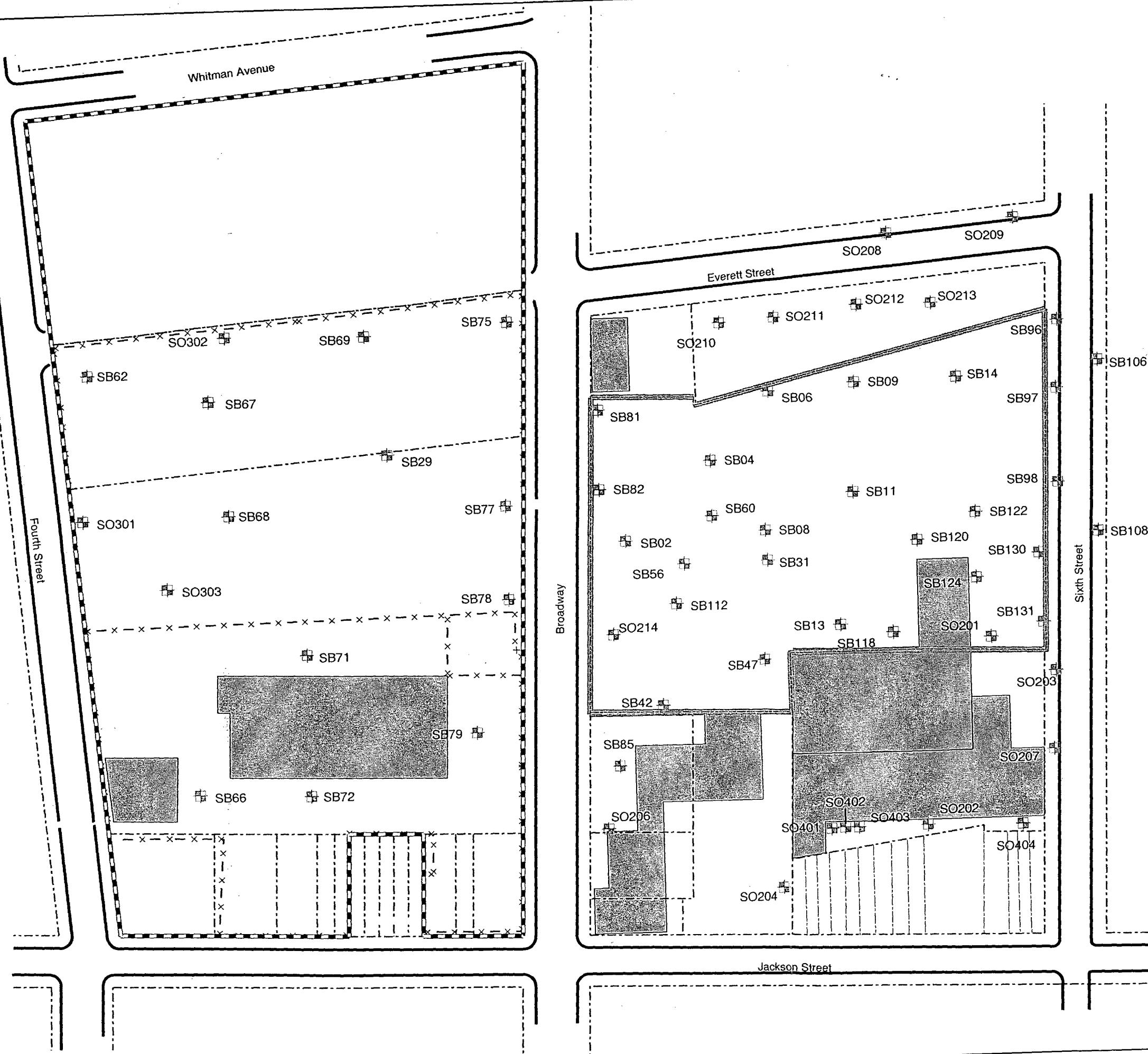


Figure 3-1
Soil Sampling Locations
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

301915

CH2MHILL



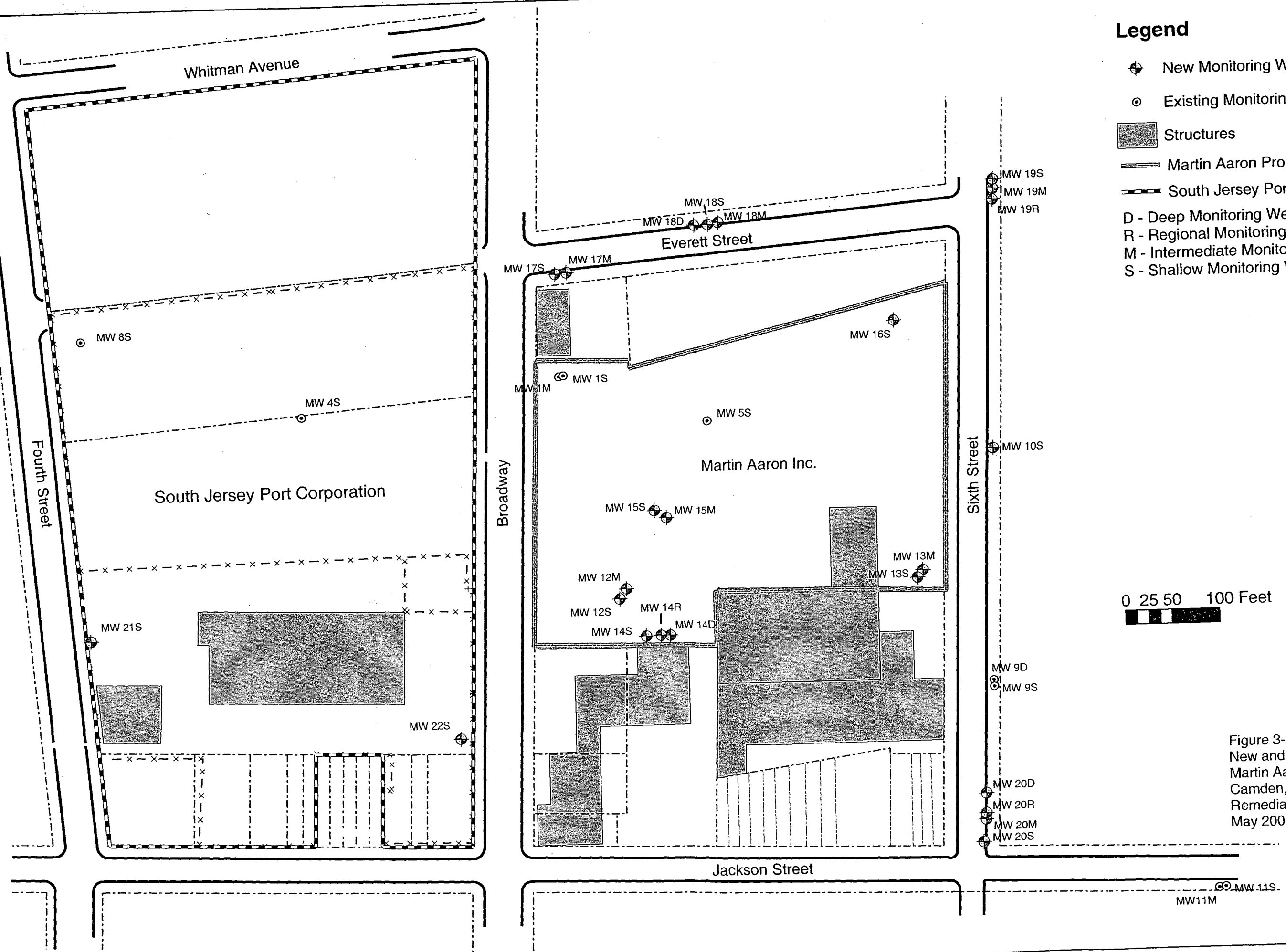


Legend

- New Monitoring Well Locations
- Existing Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- D - Deep Monitoring Well Locations
- R - Regional Monitoring Well Locations
- M - Intermediate Monitoring Well Locations
- S - Shallow Monitoring Well Locations

0 25 50 100 Feet

Figure 3-2
New and Existing Well Locations
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



301917

4. Site Characteristics

4.1 Topography

The Site is located within Camden County, New Jersey. Camden County lies entirely within the Atlantic Coastal Plain physiographic province, which extends from Massachusetts to Florida. The county is characterized as a low lying, gently rolling plain that ranges in altitude from sea level to about 220 ft. Site topography is consistent with the immediately surrounding area, generally flat, with a gradual slope toward the Delaware River. As displayed in Figure 1-2, the typical Site elevation ranges from approximately 7 to 8 ft above mean sea level (amsl) at the Rhodes Drum Building and a former debris pile. Site elevations peak at 12 to 13 ft amsl.

4.2 Climate

Camden County's climate is continental, generally moderate, with mild winters, warm summers, and generally evenly distributed rainfall. The prevailing direction of air movement is from the west to east. During the summer months, the prevailing wind direction is from the southwest.

The average annual temperature for New Jersey, according to the National Oceanic and Atmospheric Administration, dating to 1895 is 52.1 °F. The average temperature for January is 30.6 °F and July is 74 °F.

The average annual precipitation for New Jersey, according to the National Oceanic and Atmospheric Administration, dating back to 1895 is 44.7 inches. Precipitation is generally distributed evenly throughout the year, with the summer precipitation characterized by localized thundershowers. The winter precipitation is usually more widespread and less intense.

4.3 Hydrology

Extensive urban development throughout the City of Camden has significantly altered natural surface water characteristics. The nearest body of surface water is the Delaware River which lies approximately 0.75 miles west of the site. Additional water bodies near the Site include the Cooper River, 2 miles northeast and Newton Creek, 1.5 miles south.

Examination of the National Flood Insurance Program, Flood Insurance Rate Map for Camden County show that the Site is within the Delaware River's 100-year floodplain (Figure 4-1).

United States Department of the Interior National Wetlands Inventory Maps for the Camden Quadrangle does not indicate wetland areas on the Site. Wetland areas within 1 mile of the Site occur southwest and west along the Delaware River. These wetlands are

classified as Riverine, Tidal Open Waters and Riverine, Tidal Flat and Palustrine, and Open Waters.

4.4 Geology and Hydrogeology

4.4.1 Regional Geology

The Site is located in the New Jersey Coastal Plain physiographic province in an area with moderate thickness of highly permeable, unconsolidated sediments of the Pleistocene and Cretaceous age, which outcrop beneath the Site and throughout the Delaware Valley (Kummel, 1940). The New Jersey Coastal Plain province is a wedge-shaped body of unconsolidated sediments that thicken to the east toward the New Jersey shoreline. Individual units typically dip and thicken to the east and southeast. Camden is located on the Inner Coastal Plain.

Soils near the Site represent Pleistocene age deposits of the Freehold-Downer Urban Land Complex soil associations as seen on Figure 4-2. Previous reports have identified the soils as the Downer-Woodstown-Dragston series based on the United States Department of Agriculture classification. For this report, the soils were classified based on information from the NJDEP Bureau of Geographic Information and Analysis. The Freehold-Downer association consists mostly of sand and gravel deposited by streams and rivers. These soils were formed from the materials of the Cape May, Pennsauken, and Bridgeton Formations. The Downer series consists of dark grayish-brown, well-drained sandy loam grading to a yellowish-brown sandy loam subsoil. The subsoil is mottled yellowish brown or light olive brown, sandy loam containing slightly more clay than the surface layers. These soils have been greatly disturbed due to past activities.

Intrusive remedial investigation activities conducted during the NJDEP RI such as test pit excavations indicate that natural soils have been removed from the property and replaced with various fill materials, including: construction debris (bricks, concrete, etc.), ashes and cinders, slag-type material, wood, and refuse. This fill layer ranges from 2 to 7 ft thick and is relatively continuous over the entire property.

The unconsolidated sediments immediately underlying the Pleistocene deposits consist primarily of sands and gravels with intervals of silts and clays classified as continental, coastal, or marine type deposits of Early to Late Cretaceous age. These deposits make up the Magothy Formation, and the Potomac Group of the Coastal Plain. The Cretaceous sediments generally strike northeast-southwest and dip from 40 to 100 ft per mile to the southeast (Langmuir, 1969). Near the Site, these sediments comprise the PRM Aquifer System, a major source of potable water within the Coastal Plain of New Jersey. Intensive study of the PRM Aquifer System (Farlekas et al, 1976) shows a three-aquifer system in Camden County. Individual aquifer units of the PRM Aquifer System outcrop in southeastern Pennsylvania, beneath the Delaware River, and in the City of Camden. Five mappable units are defined including three aquifers designated as Upper, Middle and Lower units and two confining beds. The Upper PRM Aquifer occurs in the Magothy Formation. The Middle PRM Aquifer, confining bed, and Lower PRM Aquifer occur most closely in units of the Potomac Group (Pucci et al, 1992).

The uppermost formation near the Site, immediately underlying the Pleistocene deposits, is the Magothy Formation. The Magothy Formation is a sheet like deposit composed primarily of coarse beach sand and other near-shore marine deposits including light colored cross-stratified sand, and lenses of dark clay (Gill and Farlekas, 1969). The Magothy ranges from 0 to 45 ft thick in the Camden area, thickening to the east to more than 200 ft (Langmuir, 1969). The Magothy Formation is considered to be the uppermost water-bearing zone under the Site. Groundwater within the Magothy Formation becomes effectively confined to the east by the overlying Merchantville Formation and Woodbury Clay.

The Magothy Formation lies unconformably atop the Early Cretaceous Potomac Group. In the outcrop area of the Delaware Valley, the Potomac Group consists of fluvial continental deposits including thick interbeds of light colored sands and massive to thick bedded variegated silty clay which make up part of the remainder of the PRM system to the top of bedrock. The Raritan Formation which is typically present in the northern New Jersey Coastal Plain is absent in Camden County.

Near the Site, the Potomac Group consists of clay, silt, sand, and gravel. The fluvial depositional history of the Potomac Group sediments accounts for considerable amounts of silts and clays to be locally interbedded with sands and gravels. Sand contents of the Potomac Group sediments are generally above 70 percent. Thickness of the sand units comprising the Lower PRM Aquifer and the underlying confining unit can range up to 80 to 100 ft have been reported in area well logs (Zapeczka, 1984).

The Cretaceous deposits of the PRM system lie unconformably upon the early Paleozoic and Precambrian crystalline basement-bedrock complex. The basement rock erosional surface dips 60 to 100 ft per mile from the outcrop area west of Camden to the southeast (Langmuir, 1969). The bedrock near the Site is characterized by east- and south-trending channels carved by the ancient Schuylkill and Delaware Rivers and their tributaries. The upper surface of the bedrock has been weathered into micaceous, residual clay which probably serves as a local confining bed below the Cretaceous unconsolidated sediments (Langmuir, 1969). Bedrock depths in the area ranging up to 300 ft have been reported in well logs. The bedrock is a medium to coarse-grained foliated crystalline rock that varies in composition and texture from schist to gneiss. The lithology of the formation varies greatly in both vertical and horizontal directions. The formation was probably a sedimentary series of sandstone, siltstone, and shale that have been deformed and re-crystallized by metamorphism (Farlekas et al, 1976).

4.4.2 Regional Hydrogeology

The Site is within the outcrop area of the PRM Aquifer System. Within the PRM Aquifer System, five mappable hydrogeologic units are defined. The five units include three aquifers identified as the Upper, Middle, and Lower Aquifers, and two confining beds (Zapeczka, 1984). The PRM System in the area has been observed to be more than 300 thick. The Upper PRM Aquifer is the most extensive unit of the PRM system and coincides most closely with the Magothy Formation. The local water table has been encountered between 5.5 and 16.0 ft bgs. The confining bed between the Upper and Middle PRM Aquifers consist of thin- to thick-bedded sequences of variegated (red, gray, white) micaceous silts and clays (Zapeczka, 1984) with an estimated hydraulic conductivity of 10^{-6} cm/sec. Under the Site,

the upper confining bed was expected to be less than 20 ft thick. However, during drilling activities, the confining layer was determined to range from 20 to 40 ft thick. Drilling activities in the Middle PRM Aquifer encountered the uppermost confining layer, a stiff gray clay, at depths between 110 and 120 bgs.

The Middle and Lower PRM Aquifers are located within the Potomac Group sediments. Hydraulic conductivities within the Middle PRM Aquifer have been estimated at 10^{-4} cm/sec (EPA, 1993). The Middle PRM Aquifer has been traced within a 10- to 12-mile-wide band that parallels the outcrop area of the Delaware Valley (Zapeczka, 1984). Down-dip (east) of the Site, the Middle PRM Aquifer cannot be distinguished from sand beds comprising the Lower PRM Aquifer. Groundwater of the Middle PRM Aquifer is expected to occur under confined or leaky conditions beneath the Site. The confining bed immediately underlying the Middle PRM Aquifer consists primarily of very fine-grained silt and clay. This confining bed below Martin Aaron is generally less than 50 ft thick.

Hydraulic conductivities within the Lower PRM Aquifer have been estimated at 10^{-4} cm/sec. The Lower PRM Aquifer in the area covers approximately the same aerial extent as described for the Middle PRM Aquifer. This unit outcrops in southeastern Pennsylvania and beneath the Delaware River. In southern Camden and Gloucester counties, groundwater is often brackish.

The depth to the top of the water table has been reported to be between 3.5 and 7.5 ft bgs (NJDEP, 1988). Static water levels measured during the RI show water table levels between 5.5 and 14.6 ft bgs, and deeper groundwater levels between 13.0 and 16.0 ft bgs. Based on investigation observations and measurements, shallow groundwater flow within the Upper PRM Aquifer is to the east-southeast. Deeper groundwater flow within the Upper PRM Aquifer is to the east-southeast along the dip of the local formations. The easterly flow is expected to be additionally enhanced by groundwater withdrawal at various public and industrial supply wells located east of the Site. Subsurface structures such as building foundations, underground utilities, and storm sewer pipes at Martin Aaron are believed to influence the movement of groundwater in the surficial aquifer.

Groundwater within the confined and leaky-confined Middle and Lower PRM Aquifers is expected to flow southeast from the Site along the formation dip but may have been altered due to heavy pumping in the area.

Static groundwater levels measured within Site monitoring wells mentioned above indicate the potential for vertical (downward) groundwater movement within the Upper PRM Aquifer. Vertical movement of Site groundwater between the major aquifer units of the PRM system is expected to be limited, based on reported hydraulic conductivities of the confining beds. Water table elevations and potentiometric surfaces measured in wells completed within the Middle and Lower PRM Aquifers indicate a downward vertical gradient exists in the area. Extensive pumping and water withdrawal in the Camden area created measurable decreases in the local static water table and potentiometric surfaces which may enhance the vertical migration of shallow waters into the deeper aquifers (Langmuir, 1969).

4.4.3 Site Geology

The Site subsurface was evaluated by installing 60 borings and 12 monitoring well borings that range in from 8 to 190 ft deep. These borings and wells were installed as part of this RI. Soil boring and well construction logs from the 13 previously installed monitoring wells were also used.

The subsurface can be separated into one anthropogenic and three time-stratigraphic units that are classified according to their time of deposition. These units, from youngest to oldest, are as follows: undifferentiated debris and fill material mixed with natural deposits, probably of the Pennsauken or Cape May Formations, the Late Cretaceous Magothy Formation, and the Early Cretaceous Potomac Formation. This RI intrusively investigated the anthropogenic layer and all three time-stratigraphic units.

The anthropogenic layer consistently ranges from approximately 6 to 10 ft bgs throughout the Site with the thickest layers located near existing and formerly existing process buildings on the property. The layer consists mainly of fill material and debris including concrete, asphalt, wood, glass, brick, slag, and fly ash mixed with fine/medium grained sand. This fill material transitions into the Freehold-Downer-Urban Land Complex Association, which consists of a grayish brown silt and sand mixture.

The anthropogenic layer is underlain by the Late Cretaceous Magothy Formation. The Magothy Formation comprises the uppermost water-bearing zone beneath the Site. As shown in the soil boring logs in Appendix F, the Magothy Formation consists mainly of light gray fine/medium grained, well-sorted sands. Throughout the formation thin stringers of light gray, soft, low plasticity clay have been found (Figures 4-3, 4-4, and 4-5). Stringers range from 2 to 5 ft thick and were identified at depths ranging from 15 to 90 ft bgs. The base of the Magothy Formation ranges in depth from 113 ft bgs in the northeast to 120 ft bgs in the southwest.

A thin clay layer marks the base of the Magothy Formation. This layer consists of a light gray, high plasticity, hard clay. Beneath the Site, this clay confining layer is approximately 20 ft thick and ranges in depth from 113 ft bgs in the northeast to 120 ft bgs in the southwest.

The Magothy Formation is underlain by the Early Cretaceous Potomac Formation. At least two monitoring wells (MW-14D and MW-18D) were screened within the Potomac Formation. Intrusive investigation was limited to approximately 15 ft below the bottom of the clay confining layer. Therefore, only a small portion of the formation can be described. The uppermost 15 ft of the Potomac Formation consists of yellowish/brown medium/coarse, poorly sorted sand, and gravel. Thin stringers of brown, fine/medium moderately sorted sand, and silt were also identified.

4.4.4 Site Hydrogeology

The six time-stratigraphic units beneath the Site can be categorized into hydrostratigraphic units according to their hydraulic properties and significance (Figure 4-6). The Site is underlain by three aquifers and three confining units as follows: the Upper PRM Aquifer, an intermittent confining unit, the Middle PRM Aquifer, a continuous clay confining unit, the Lower PRM Aquifer, and a basal confining unit defined by the Wissahickon Formation. For

this RI, only the Upper PRM and the upper portion of the Middle PRM Aquifers have been investigated.

4.4.4.1 Upper PRM Aquifer

Beneath the Site, the Upper PRM Aquifer is under unconfined conditions and consists of sandy soils of the Magothy Formation in hydraulic connection with the surficial anthropogenic fill materials. The Upper PRM Aquifer ranges from 110 ft thick in the northeast to 94 ft in the southwest.

As part of this RI, a total of 21 monitoring wells were installed in the Upper PRM Aquifer. During previous investigations 13 monitoring wells were installed in the aquifer. Of the 13 previously installed monitoring wells, 10 have been located. Therefore, a total of 31 monitoring wells are presently installed in the Upper PRM Aquifer system at the Site.

Monitoring wells screened in the Upper PRM Aquifer, monitor all intervals of the unit including the water table (S-wells), the central portion of the unit (M-wells) and at the basal confining bed (R-wells).

Synoptic water level measurements were collected in June and September 2002. The data was used to generate potentiometric surface maps for the Surficial Upper PRM Aquifer. Shallow monitoring wells were set to straddle the groundwater table and were used to generate a potentiometric map of the surficial water table for June and September 2002 (Figures 4-7 and 4-8). Intermediate monitoring wells were set at approximately the central portion of the Upper PRM Aquifer and were used to generate potentiometric maps of the main water bearing unit of the aquifer for June and September 2002 (Figures 4-9 and 4-10).

The potentiometric maps for the shallow and intermediate wells for the June and September 2002 water level surveys showed groundwater flow generally southeast, away from the Delaware River along a gradient of .011 ft/ft. However, the potentiometric maps for the central Upper PRM Aquifer show the groundwater flow direction to be slightly different between the two events. In June 2002, the groundwater flow appears to be east along a gradient of .0035 ft/ft, and in September 2002 groundwater flows on a gradient of .0021 ft/ft southeast.

Vertical gradients in the Upper PRM Aquifer for the two periods of synoptic measurements, ranged from 0.004 ft/ft to 0.29 ft/ft and are uniformly downward (Table 4-1). The greatest vertical gradients occurred in between the water table and central portion of the Upper PRM Aquifer, particularly across the discontinuous clay unit that occurs near the ground surface. The magnitude of the vertical gradients decline with depth. Downward gradients measured in the MW-14 and MW-18 monitor well clusters also occur between the Upper PRM Aquifer and the underlying Middle PRM Aquifer.

A tidal survey was conducted using eight wells (MW-8S, MW-15S, MW-19S, MW-20S & MW-21S) set in the Surficial Upper PRM Aquifer, two wells (MW-14D and MW-18D) in the Middle PRM Aquifer, and one well (MW-20D) screened in an isolated sand bed between the two aquifers. The tidal survey was conducted between June 5 and June 10, 2002. A detailed description of which wells were selected and the procedures used can be found in Section 3.2.8 of this RI. Data from pressure transducers set in the wells during the tidal survey was used to determine if groundwater in the Upper PRM Aquifer was tidally influenced. This

data was compared to baseline tidal data from the Delaware River recorded at the United States Coast Guard (USCG) water level station in Philadelphia.

Water levels in monitor wells used for the tidal survey fluctuated up to 0.2 feet over the monitoring period. All of the monitor wells screened near the base of the Upper PRM Aquifer, or in the isolated sand unit between the Upper and Middle PRM Aquifers (MW-14R, MW-19R, MW-20R, and MW-20D) exhibited the cyclical peaks and troughs typical of tidal influence. Tidal features in these hydrographs, although apparent are small, showing only 0.02 feet fluctuation. Hydrographs from several wells screened near the water table including MW-5S, MW-8S, and MW-20S also exhibited minor tidal features. MW-5S and MW-20S are screened below the top of a discontinuous clay unit which may confine the underlying sands, and conduct tidal loading effects.

Hydraulic conductivity tests were performed at all existing and newly installed monitoring wells. A detailed description of the hydraulic conductivity test procedures can be found in Section 3.2.9 of this RI. In the Upper PRM Aquifer, values for hydraulic conductivity ranged from approximately 1×10^{-2} to 99 ft/day (Table 4-2). The lowest value was recorded in a shallow monitoring well that straddled the groundwater table and the highest value recorded at an intermediate well set near the middle of the aquifer. Average hydraulic conductivity's calculated for the shallow, intermediate, and regional wells show an increasing trend with depth. The average hydraulic conductivity for the shallow wells was 2.8×10^{-1} ft/day, 4.79 ft/day for the intermediate wells, and 6.29 ft/day for the regional wells.

4.4.4.2 Middle PRM Aquifer

The Upper PRM Aquifer is underlain by an intermittent clay confining unit that separates the Upper PRM from the Middle PRM Aquifer. The Middle PRM consists of sands and gravels of the Potomac Formation that range up to approximately 100 ft thick. Monitoring wells MW-14D and MW-18D are screened near the top of the aquifer.

The confining unit between the Upper and Middle PRM Aquifers, appears to be relatively complex with up to four discrete clay units (Figures 4-4 and 4-5). Individual clay units range in thickness from 4 to 12 feet. A relatively continuous sand unit is interbedded with the clay beds. The sand unit ranges in thickness from 4 to 20 feet. MW-14R, MW-20R, and MW-20D are screened in this isolated sand unit between the Upper and Middle PRM Aquifers.

Two rounds of synoptic water level measurements were conducted in June and September 2002. As only two wells are screened in the Middle PRM Aquifer a potentiometric surface map cannot be generated. Potentiometric elevations from the September 2002 synoptic episode are the same in MW-14D and MW-18D. Vertical gradients between the Middle PRM Aquifer and overlying Upper PRM Aquifer ranges around 0.02 ft/ft in both well clusters, for the two measurement periods.

A tidal survey was conducted in two wells (MW-14D and MW-18D) in the Middle PRM Aquifer between June 5 and June 10, 2002. Section 3.2.8 provides a description of the wells selected and the procedures used for the tidal survey. Data from pressure transducers set in the wells during the tidal survey was used to determine if groundwater in the Middle PRM Aquifer was tidally influenced. This data was compared to baseline tidal data from the

Delaware River recorded at the United States Coast Guard (USCG) water level station in Philadelphia.

Graphical results of the tidal survey can be seen in Appendix D. When compared to tide charts of the Delaware River, it appears that the Middle PRM Aquifer is strongly tidally influenced. Tidal fluctuations appear to control potentiometric elevations in monitor wells in the Middle PRM Aquifer. Over the period of the study, MW-14D exhibited the greatest fluctuation with an amplitude of 0.3 feet between each tidal cycle. In a confined aquifer, the weight of the encroaching tidal wedge compresses the aquifer skeleton, increasing potentiometric pressure. As the tide recedes, potentiometric pressure falls as the weight is removed, thus lowering the water level.

Hydraulic conductivity tests were performed at the two newly installed monitoring wells in the Middle PRM Aquifer. The wells were set just below the clay confining layer separating the Middle and Upper PRM Aquifers. A detailed description of the hydraulic conductivity test procedures can be found in Section 3.2.9 of this RI. In the Middle PRM Aquifer, values for hydraulic conductivity were similar to the Upper PRM Aquifer and ranged from approximately 1.12 to 3.27 ft/day (Table 4-2).

4.5 Local Demographics and Land Use

The Site is located in the City of Camden, Camden County, New Jersey. The City of Camden occupies 10.38 square miles. According to the 2001 Census, Camden is populated with approximately 79,904 people. Incorporated as a city in 1929, Camden was known for its shipyards and industry along the adjacent Delaware River. Since 1950, manufacturing sales, and employment have declined in Camden. Approximately 13 percent of Camden City residents work in Pennsylvania. The City of Camden is mixed with residential, commercial, and industrial properties. Similarly, the area surrounding the Site is also mixed with residential, industrial, and commercial properties.

Camden County is comprised of 37 municipalities. The county occupies 222.3 square miles. According to the 2000 Census, Camden County, the most-populated southern New Jersey County, has 508,932 people. This is an increase from the 1990 population of 502,824 people. The services sector was the county's largest employer accounting for 35 percent of the workplace, or 83,281 persons. Likewise, the trade sector was the second-largest category accounting for 23 percent, or 53,068 persons.

TABLE 4-1
Vertical Hydraulic Gradients, June & September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Well Number	Reference	Reference Elevation (feet above MSL)	Well Depth (ft below grade)	Well Depth (ft elevation)	June 2002		September 2002		Vertical Gradient (ft/ft)	Comments
					Depth to Water (feet)	Water Elevation (feet)	Depth to Water (feet)	Water Elevation (feet)		
MW-1M	TIC	6.48	60.00	-53.52	13.18	-6.70	13.41	-6.93		
MW-1S	TIC	6.70	14.00	-7.30	5.75	0.95	6.48	0.22	0.154694937	Downward
MW-4S	TIC	6.17	14.00	-7.83	5.60	0.57	5.70	0.47		
MW-5S	TIC	7.69	16.00	-8.31	6.60	1.09	8.22	-0.53		
MW-8S	TIC	6.15	14.00	-7.85	5.80	0.35	5.92	0.23		
MW-9D	TIC	6.94	54.50	-47.56	14.32	-7.38	14.55	-7.61		
MW-9S	TIC	6.84	24.00	-17.16	14.42	-7.58	14.65	-7.81	-0.006578947	Upward
MW-10S	TIC	5.99	18.00	-12.01	12.61	-6.62	12.91	-6.92		
MW-11M	TIC	5.05	56.00	-50.95	13.01	-7.96	13.29	-8.24		
MW-11S	TIC	5.02	21.00	-15.98	12.98	-7.96	13.23	-8.21	0.000857878	Downward
MW-12M	TIC	6.22	48.10	-41.88	13.19	-6.97	13.54	-7.32		
MW-12S	TIC	6.74	15.40	-8.66	11.33	-4.59	11.50	-4.76	0.077062011	Downward
MW-13M	TIC	7.33	58.40	-51.07	14.45	-7.12	15.12	-7.79		
MW-13S	TIC	7.66	16.60	-8.94	8.11	-0.45	7.26	0.40	0.194398291	Downward
MW-14D	TIC	6.15	185.00	-178.85	14.45	-8.30	15.06	-8.91		
MW-14R	TIC	6.18	118.00	-111.82	13.49	-7.31	13.87	-7.69	0.018200806	Downward
MW-14S	TIC	6.26	17.00	-10.74	10.10	-3.84	10.78	-4.52	0.031361298	Downward
MW-15M	TIC	6.92	69.40	-62.48	13.99	-7.07	14.30	-7.38		
MW-15S	TIC	7.03	16.80	-9.77	11.74	-4.71	12.48	-5.45	0.036615443	Downward
MW-16S	TIC	7.53	16.50	-8.97	6.73	0.80	7.43	0.10		
MW-17M	TIC	7.02	51.80	-44.78	13.30	-6.28	13.74	-6.72		
MW-17S	TIC	7.00	18.00	-11.00	6.70	0.30	6.95	0.05	0.200414446	Downward
MW-18D	TIC	7.17	150.00	-142.83	15.21	-8.04	16.08	-8.91		
MW-18M	TIC	7.40	41.70	-34.30	13.85	-6.45	14.24	-6.84	0.019073067	Downward
MW-18S	TIC	7.16	17.80	-10.64	10.82	-3.66	6.95	0.21	0.29797126	Downward
MW-19M	TIC	6.46	52.00	-45.54	13.08	-6.62	13.48	-7.02		
MW-19R	TIC	6.46	110.00	-103.54	15.60	-9.14	13.98	-7.52	0.00862069	Downward
MW-19S	TIC	6.37	15.00	-8.63	6.42	-0.05	6.89	-0.52	0.073754083	Downward
MW-20D	TIC	6.61	143.00	-136.39	15.11	-8.50	15.43	-8.82		
MW-20M	TIC	6.67	52.00	-45.33	14.00	-7.33	14.40	-7.73	0.01197013	Downward
MW-20R	TIC	6.47	121.00	-114.53	14.47	-8.00	14.45	-7.98	0.003612717	Downward
MW-20S	TIC	6.28	17.90	-11.62	13.60	-7.32	13.98	-7.70	0.002720824	Downward
MW-21S	TIC	5.97	21.00	-15.03	12.20	-6.23	12.51	-6.54		
MW-22S	TIC	6.89	21.00	-14.11	12.30	-5.41	12.22	-5.33		
Notes:										
TIC - Top of inner casing										
MSL - Mean sea level										

TABLE 4-2
Hydraulic Conductivity Testing Results
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Well ID	Test No	Test Type	Bouwer and Rice		Aquifer
			ft/day	cm/sec	
MW1S	1	Rising Head Test	4.23E-01	1.49E-04	Surficial Upper PRM
	2	Rising Head Test	4.61E-01	1.62E-04	Surficial Upper PRM
MW1M	1	Falling Head Test	9.04	3.18E-03	Upper PRM
	2	Rising Head Test	8.27	2.91E-03	Upper PRM
MW4S	1	Rising Head Test	6.84E-02	2.41E-05	Surficial Upper PRM
	2	Rising Head Test	4.64E-02	1.63E-05	Surficial Upper PRM
	3	Rising Head Test	2.84E-01	1.00E-04	Surficial Upper PRM
MW5S	1	Rising Head Test	8.99E-01	3.17E-04	Surficial Upper PRM
	2	Rising Head Test	4.56E-01	1.61E-04	Surficial Upper PRM
MW8S	1	Rising Head Test	2.61E-01	9.20E-05	Surficial Upper PRM
MW9S	1	Falling Head Test	1.58	5.57E-04	Surficial Upper PRM
	2	Rising Head Test	1.04	3.66E-04	Surficial Upper PRM
	3	Rising Head Test	1.78	6.27E-04	Surficial Upper PRM
MW9D	1	Falling Head Test	3.36	1.18E-03	Upper PRM
	2	Rising Head Test	5.08	1.79E-03	Upper PRM
MW10S	1	Rising Head Test	1.38	4.86E-04	Surficial Upper PRM
	2	Rising Head Test	3.28	1.16E-03	Surficial Upper PRM
MW11S	1	Rising Head Test	4.75E-01	1.67E-04	Surficial Upper PRM
	2	Rising Head Test	3.96E-01	1.40E-04	Surficial Upper PRM
MW11M	1	Falling Head Test	4.99	1.76E-03	Upper PRM
	2	Rising Head Test	1.90	6.69E-04	Upper PRM
MW12S	1	Rising Head Test	9.93E-02	3.50E-05	Surficial Upper PRM
MW12M	1	Falling Head Test	1.79E-01	6.31E-05	Upper PRM
	2	Rising Head Test	2.02	7.12E-04	Upper PRM
MW13S	1	Rising Head Test	1.14E-02	4.02E-06	Surficial Upper PRM
	2	Rising Head Test	1.74E-02	6.13E-06	Surficial Upper PRM
MW13M	1	Falling Head Test	7.00	2.47E-03	Upper PRM
	2	Rising Head Test	1.25	4.40E-04	Upper PRM
	3	Rising Head Test	3.98	1.40E-03	Upper PRM
MW14S	1	Rising Head Test	8.71E-02	3.07E-05	Surficial Upper PRM
	2	Rising Head Test	2.97E-02	1.05E-05	Surficial Upper PRM
MW14R	1	Falling Head Test	1.56	5.50E-04	Basal Upper PRM
	2	Rising Head Test	1.59	5.60E-04	Basal Upper PRM
MW14D	1	Falling Head Test	2.26	7.96E-04	Upper Middle PRM
	2	Rising Head Test	2.37	8.35E-04	Upper Middle PRM
MW15S	1	Rising Head Test	5.39E-02	1.90E-05	Surficial Upper PRM
	2	Rising Head Test	7.49E-02	2.64E-05	Surficial Upper PRM

TABLE 4-2
Hydraulic Conductivity Testing Results
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Well ID	Test No	Test Type	Bouwer and Rice		Aquifer
			ft/day	cm/sec	
MW15M	1	Falling Head Test	39.77	1.40E-02	Upper PRM
	2	Rising Head Test	99.68	3.51E-02	Upper PRM
MW16S	1	Falling Head Test	5.96E-01	2.10E-04	Surficial Upper PRM
	2	Rising Head Test	4.98E-01	1.75E-04	Surficial Upper PRM
MW17S	1	Falling Head Test	8.64E-01	3.04E-04	Surficial Upper PRM
	2	Rising Head Test	6.22E-02	2.19E-05	Surficial Upper PRM
MW17M	1	Falling Head Test	5.76	2.03E-03	Upper PRM
	2	Rising Head Test	3.95	1.39E-03	Upper PRM
MW18S	1	Falling Head Test	4.10E-01	1.44E-04	Surficial Upper PRM
	2	Rising Head Test	3.27E-01	1.15E-04	Surficial Upper PRM
MW18M	1	Falling Head Test	5.21E-01	1.84E-04	Upper PRM
	2	Rising Head Test	1.35	4.76E-04	Upper PRM
MW18D	1	Falling Head Test	1.12	3.95E-04	Upper PRM
	2	Rising Head Test	1.59	5.60E-04	Upper PRM
MW19S	1	Rising Head Test	2.79E-02	9.83E-06	Surficial Upper PRM
	2	Rising Head Test	9.53E-02	3.36E-05	Surficial Upper PRM
MW19M	1	Falling Head Test	1.34	4.72E-04	Upper PRM
	2	Rising Head Test	2.67	9.41 E-04	Upper PRM
MW19R	1	Falling Head Test	4.08	1.44E-03	Basal Upper PRM
	2	Rising Head Test	6.99	2.46E-03	Basal Upper PRM
MW20S	1	Rising Head Test	4.32E-01	1.52E-04	Surficial Upper PRM
	2	Rising Head Test	8.04E-01	2.83E-04	Surficial Upper PRM
MW20M	1	Rising Head Test	28.89	1.02E-02	Upper PRM
	2	Falling Head Test	5.65	1.99E-03	Upper PRM
MW20R	1	Falling Head Test	33.65	1.19E-02	Basal Upper PRM
	2	Rising Head Test	23.20	8.17E-03	Basal Upper PRM
MW20D	1	Falling Head Test	1.80	6.34E-04	Confined sand unit between Upper and Middle PRM Aquifers
	2	Rising Head Test	3.27	1.15E-03	
MW21S	1	Rising Head Test	5.61E-01	1.98E-04	Surficial Upper PRM
	2	Rising Head Test	1.91E-01	6.73E-05	Surficial Upper PRM
MW22S	1	Rising Head Test	8.02E-01	2.83E-04	Surficial Upper PRM

TABLE 4-3
Depths of Monitoring Well Screens and Clay Layers
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
December 2004

Well ID	Well Screen Interval (ft bgs)	Depth of Clay Layer (ft bgs)
Cross-Section A – A' from Figure 4-4		
MW22S	11 – 21	NM
MW14S	10 – 20	17 – 21
MW14R	109.5 – 119.5	98 – 106.5 109 – 111 119 – 123.5
MW14D	178 – 188	NM
MW12S	5.4 – 15.4	11 – 24
MW12M	38.1 – 48.1	33 – 38 49.5 – 52
MW15S	6.8 – 16.8	18.5 – 22 28.5 – 30
MW15M	59.4 – 69.4	NM
MW5S	6.5 – 16.5	9 – 24
MW16S	6.5 – 16.5	11 – 21.5
MW19S	5.05 – 15.05	9 – 12.5 20 – 22
MW19M	41.8 – 51.8	53 – 55
MW19R	103 – 113	111 – 117
Cross-Section B – B' from Figure 4-5		
MW4S	5 – 15	NM
MW12S	5.4 – 15.4	9 – 13 15 – 24
MW12M	38.1 – 48.1	33.5 – 39.5
MW14S	10 – 20	16 – 20
MW14R	109.5 – 119.5	97 – 107 110 – 113
MW14D	178 – 188	168.5 – 170

TABLE 4-3
Depths of Monitoring Well Screens and Clay Layers
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
December 2004

Well ID	Well Screen Interval (ft bgs)	Depth of Clay Layer (ft bgs)
MW20S	7.9 – 17.9	10 – 21
MW20M	38.5 – 48.5	44 – 46 52.5 – 55
MW20R	113 – 123	95 – 118 120 – 125
MW20D	128 – 133	134 – 146
MW11S	12 – 22	NM
MW11M	48.5 – 58.5	NM
Notes: bgs – below ground surface NM – no clay measured at this monitoring well location		

301932



Legend

500-Year Flood Boundary	Zone Designations*
100-Year Flood Boundary	Zone B
Zone Designations*	Zone A1
	Zone A2
	Zone B
100-Year Flood Boundary	
500-Year Flood Boundary	
Base Flood Elevation Line With Elevation in Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	IEL 5971
Elevation Reference Mark	RM7x
River Mile	M1.5
** Referenced to the National Geodetic Vertical Datum of 1929	

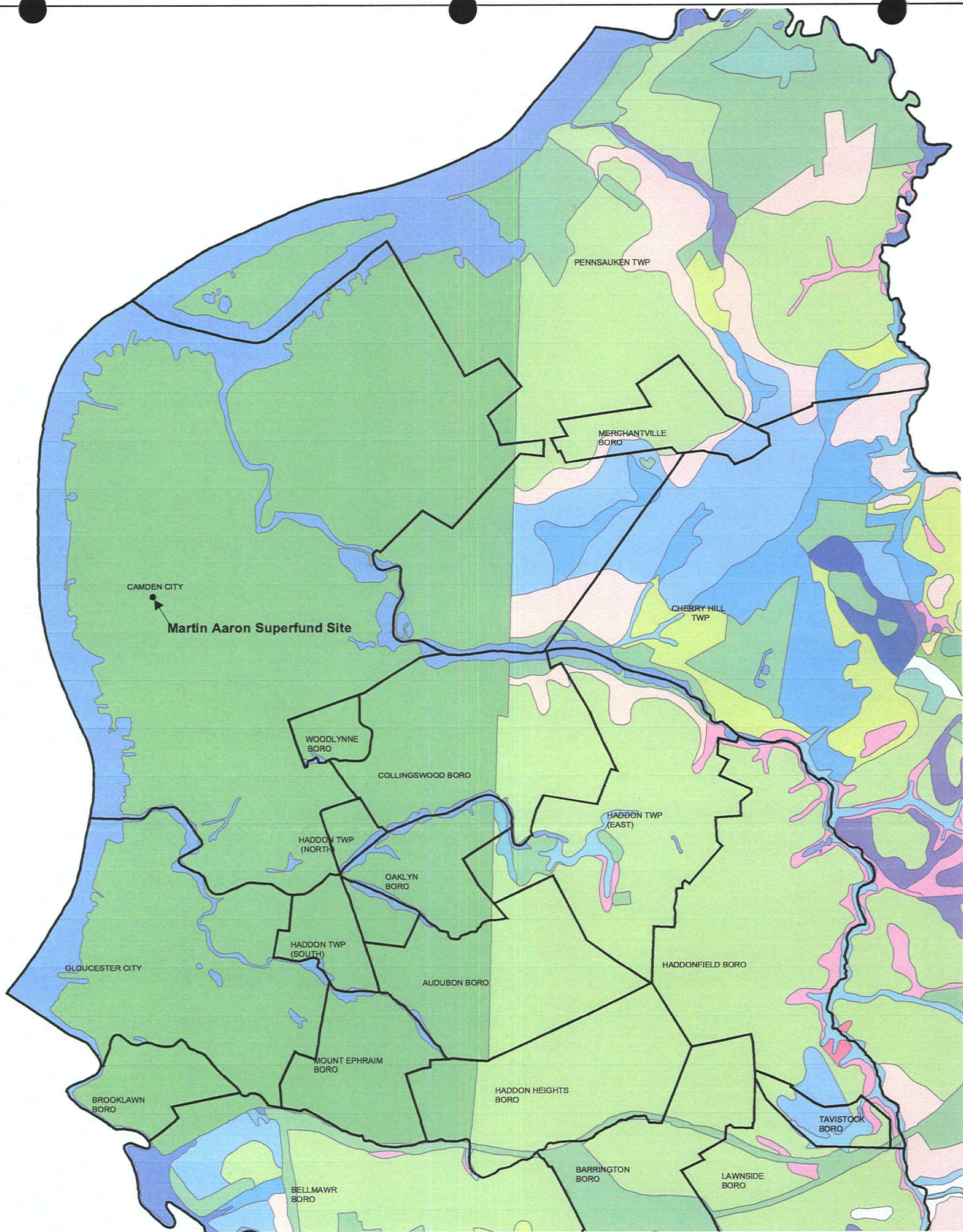
- A Areas of 100-year flood; base flood elevations and flood hazard factors not determined
- A1-A30 Areas of 100-year flood; base flood elevations and flood hazard factors determined.
- B Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood (Medium shading)
- C Areas of minimal flooding. (No shading)

Martin Aaron Superfund Site

Figure 4-1
Flood Insurance Rate Map
Martin Aaron Superfund Site
Camden County, NJ
Remedial Investigation Report
May 2004

Source: National Flood Insurance Program
City of Camden, New Jersey
Community Panel Number 3401280003
December 1, 1991

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the block. For the latest product information about National Flood Insurance Program flood maps, check the FEMA Flood Map Store at www.msc.fema.gov.



- Legend**
- | | | |
|--|--|---|
| <ul style="list-style-type: none"> Municipalities Aura loamy sand, 0 to 5 percent slopes Aura sandy loam, 0 to 2 percent slopes Aura-Urban land complex, 0 to 5 percent slopes Fluvaquents, loamy, frequently flooded Freehold loamy fine sand, 0 to 5 percent slopes Freehold loamy fine sand, 5 to 10 percent slopes Freehold fine sandy loam, 0 to 2 percent slopes Freehold fine sandy loam, 2 to 5 percent slopes Freehold-Downer-Urban land complex, 0 to 5 percent slopes | <ul style="list-style-type: none"> Freehold-Downer-Urban land complex, 5 to 10 percent slopes Freehold-Downer, clayey substratum-Urban land complex, 0 to 5 percent slopes Holmdel fine sandy loam, 0 to 2 percent slopes Holmdel loamy fine sand, 0 to 5 percent slopes Holmdel fine sandy loam, 0 to 2 percent slopes Holmdel-Urban land complex, 0 to 5 percent slopes Holmdel, clayey substratum-Urban land complex, 0 to 5 percent slopes Howell-Urban land complex, 0 to 5 percent slopes Howell-Urban land complex, 5 to 10 percent slopes Mannington-Nanticoke-Udorthents complex, very frequently flooded | <ul style="list-style-type: none"> Marton sandy loam, 2 to 5 percent slopes Moderately wet land Pits, sand and gravel Psamments, nearly level Shrewsbury fine sandy loam Shrewsbury-Urban land complex Urban land Urban land-Udiluvents complex Udorthents, refuse substratum Water |
|--|--|---|

Source: New Jersey Department of Environmental Protection
Bureau of Geographic Information and Analysis
Camden County Soils

Figure 4-2
Survey of Camden County Soils
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

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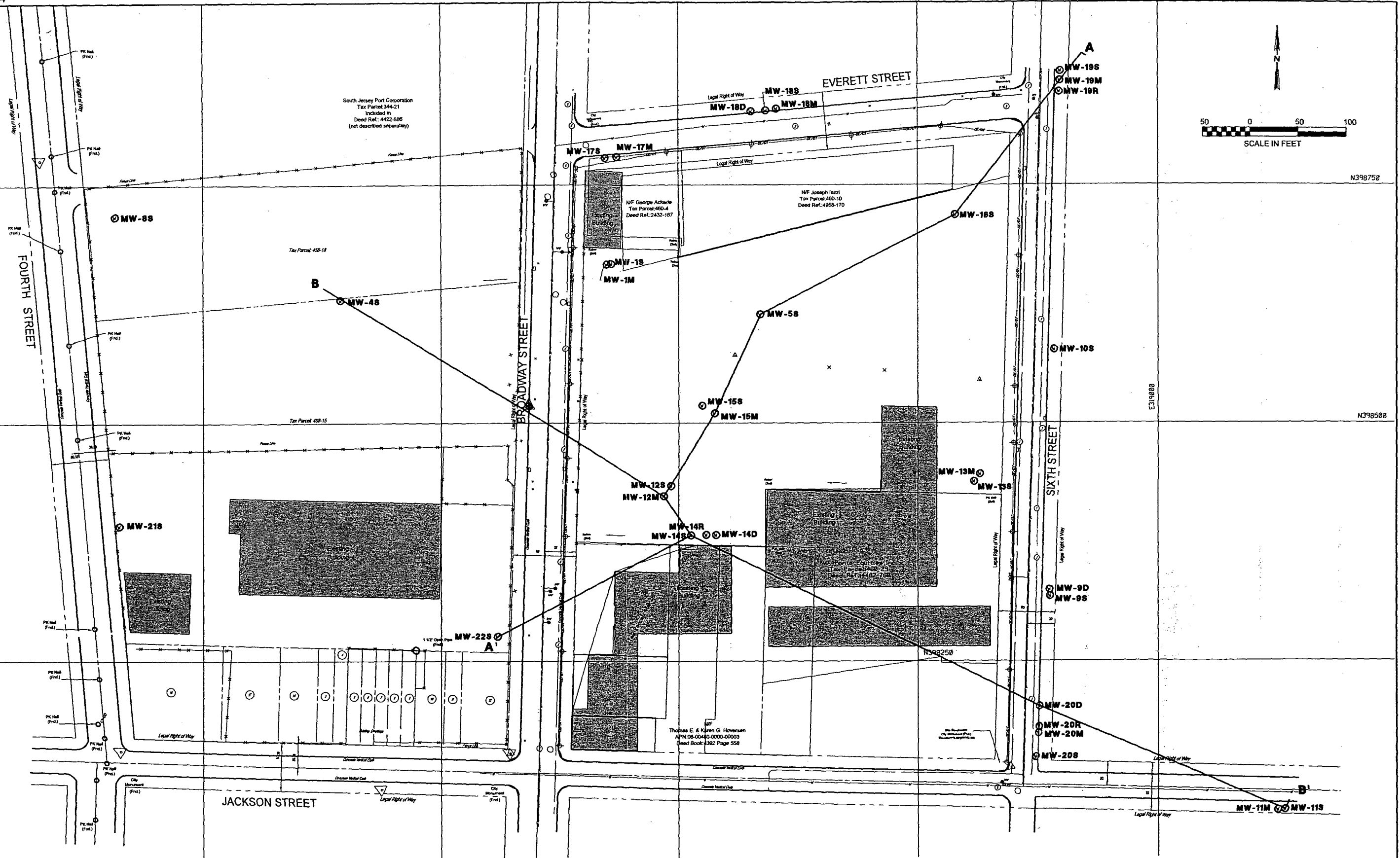
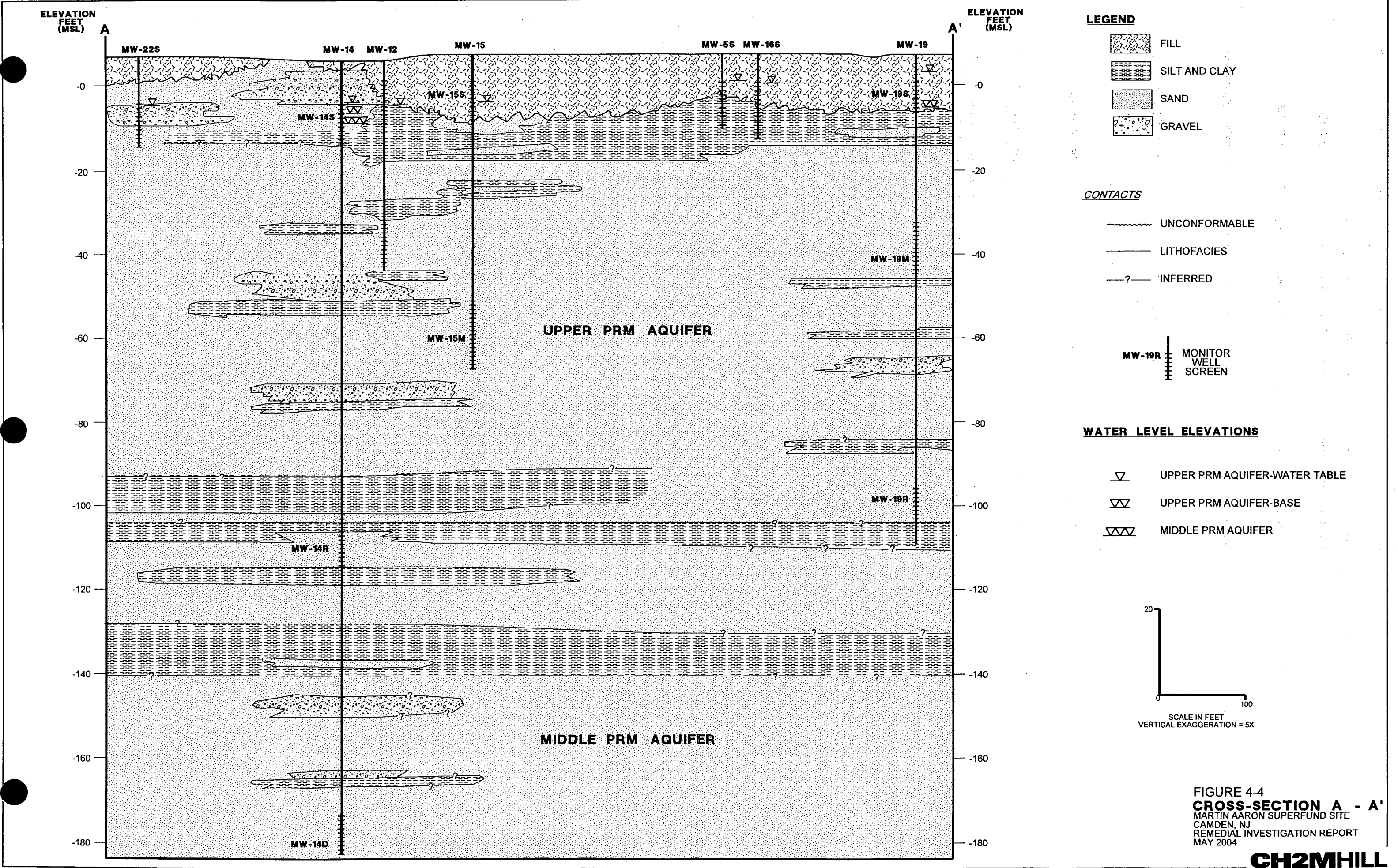
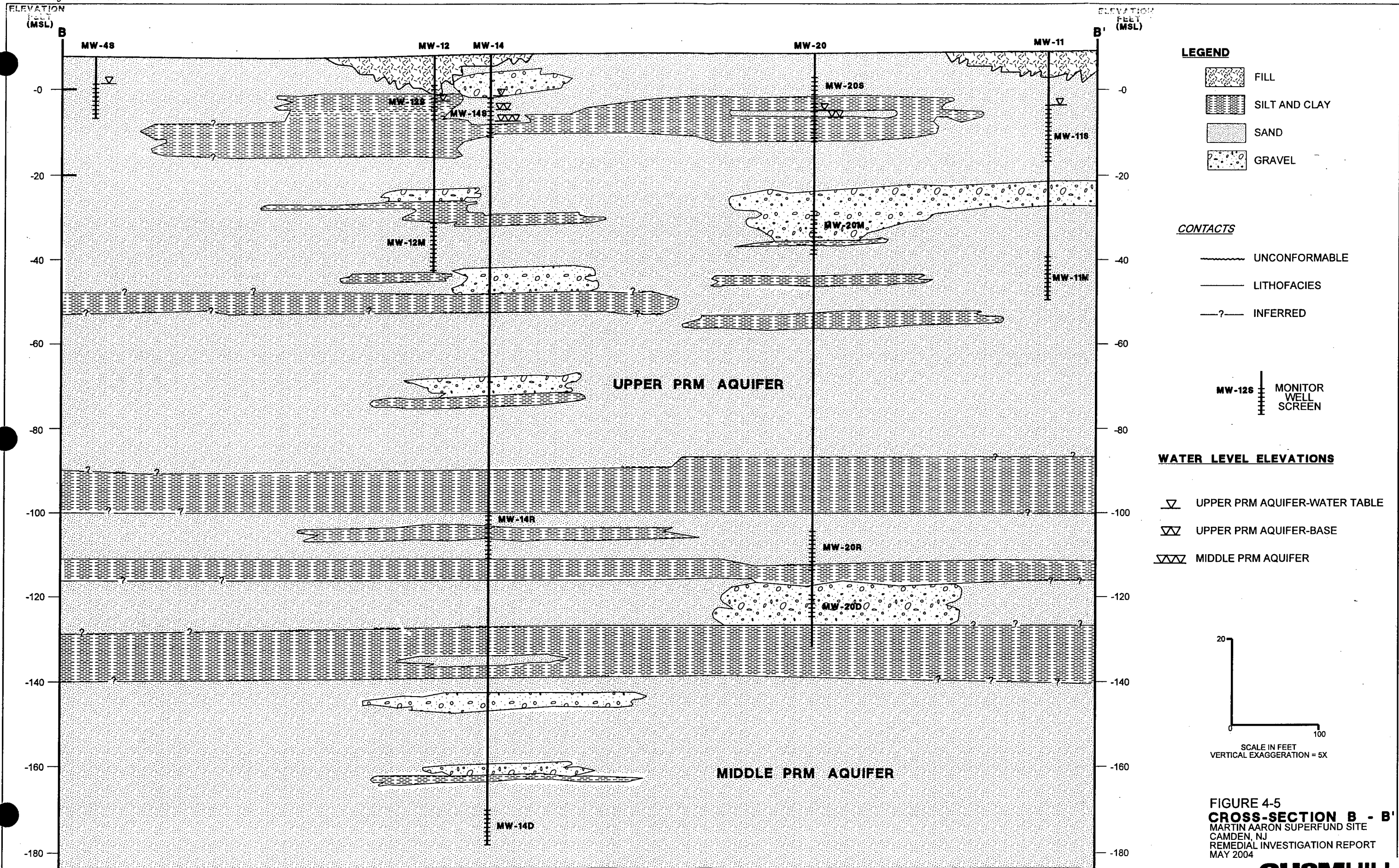


Figure 4-3
CROSS SECTION A-A' AND B-B'
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004





Graphical Column	Hydrogeological Units Description	Thickness (Ft.)	Time Stratigraphic Unit
	Surficial Aquifer	0 - 17	Fill Recent Alluvium Cape May Formation(s)
		0 - 20	
		0 - 40	
	Potomac-Raritan-Magothy Upper Aquifer	10 - 70	Magothy Formation
	Intermittant Clay	0 - 15	Potomac Formation
	Potomac-Raritan-Magothy Upper Middle Aquifer	60 - 70	
	Confining Layer	10 - 20	
	Potomac-Raritan-Magothy Lower Middle Aquifer	20 - 25 (total sand thickness)	
	Confining Layer	8 - 15	
	Potomac-Raritan-Magothy Lower Aquifer	90	Wissahickon Formation
	Bedrock Confining Bed		

(Sources: Zapecza, 1989; Kozlinsky, 1990)

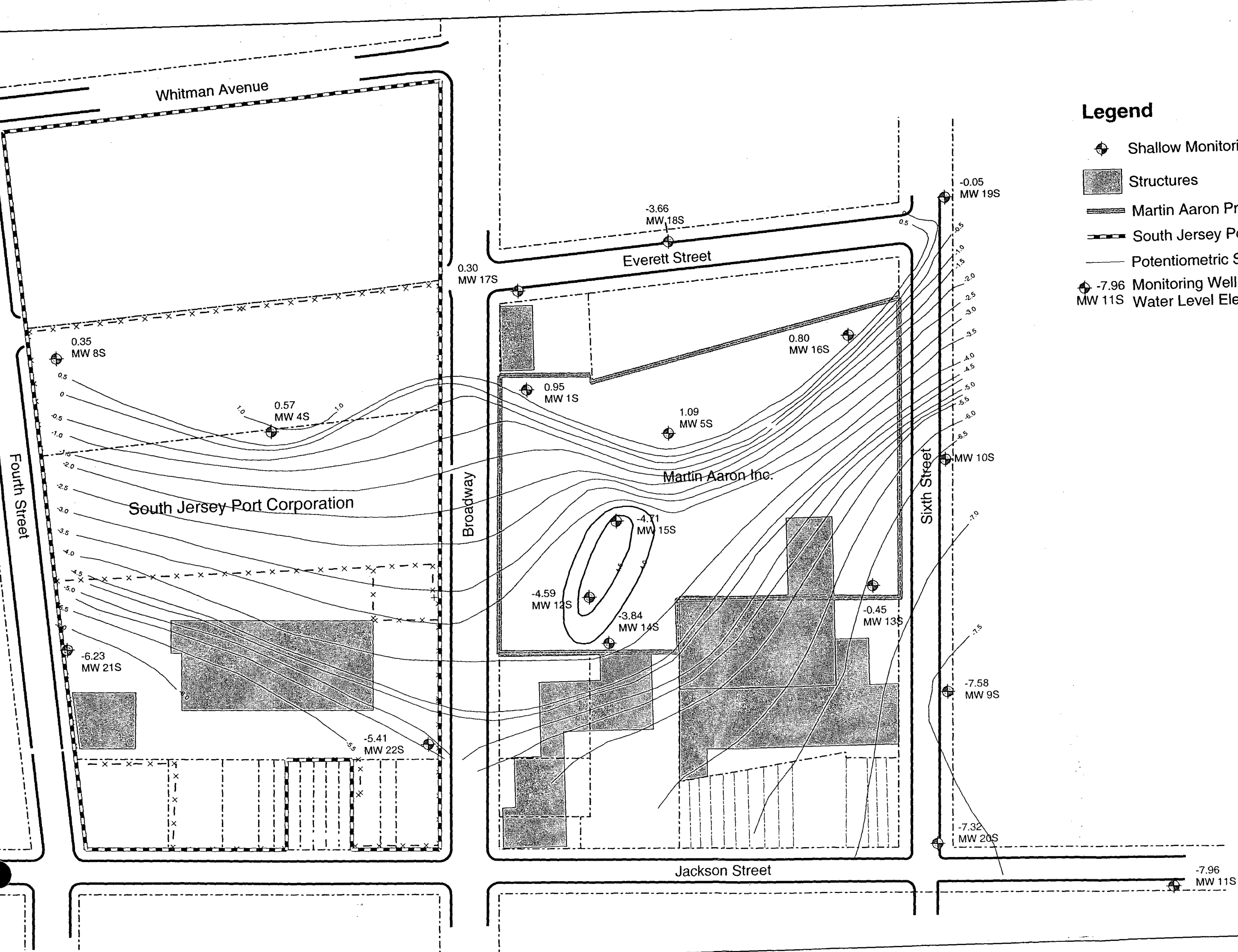
FIGURE 4-6
**TIME STRATIGRAPHIC
 AND HYDROSTATIC UNITS
 BENEATH STUDY AREA**
 MARTIN AARON SUPERFUND SITE
 CAMDEN, NJ
 REMEDIAL INVESTIGATION REPORT
 MAY 2004

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Legend

- Shallow Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Potentiometric Surface Lines
- 7.96 Monitoring Well with
MW 11S Water Level Elevation



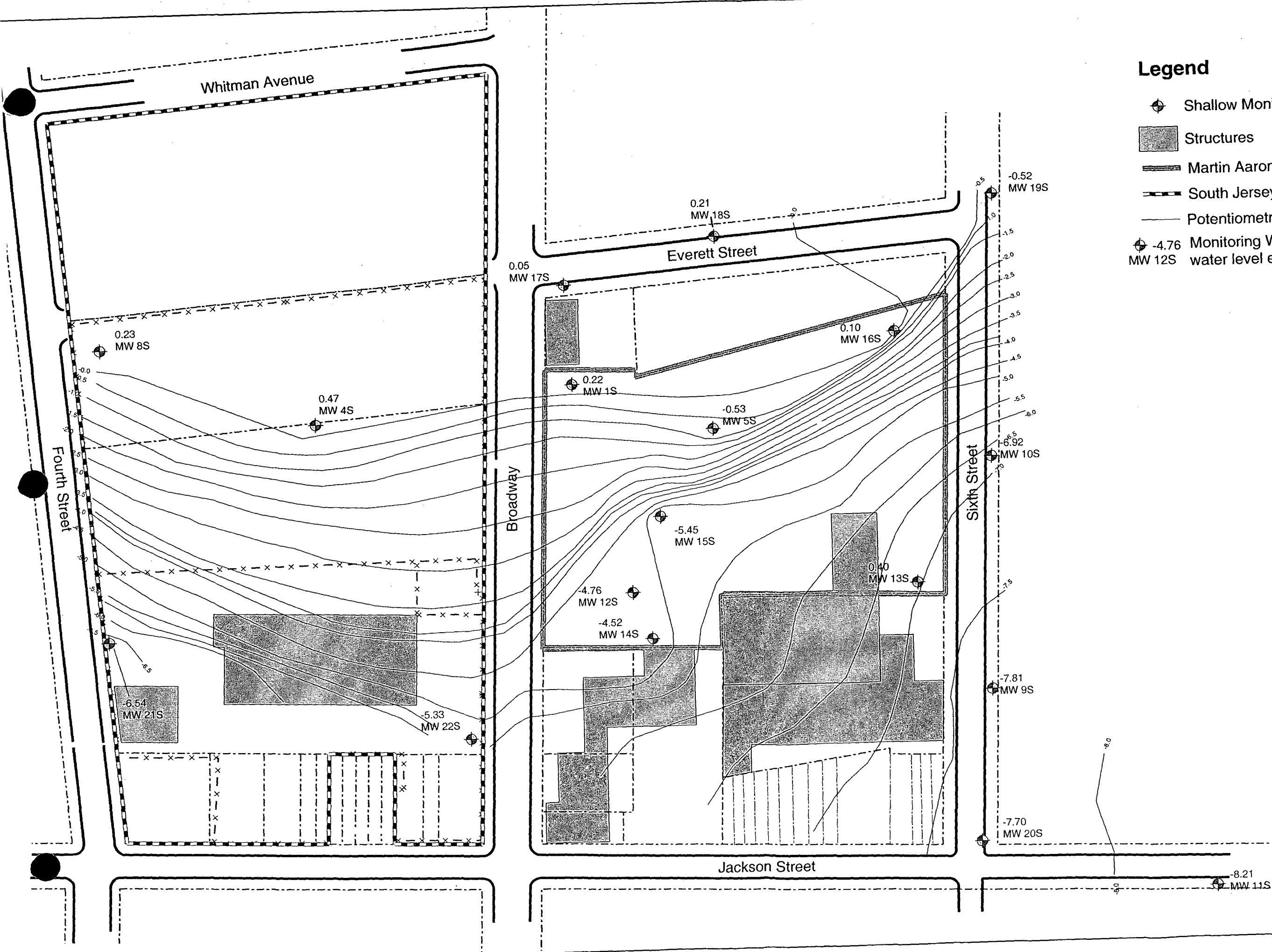
0 25 50 100 Feet

Figure 4-7
Potentiometric Surface Map
Surficial Upper PRM Aquifer
June 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- Shallow Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Potentiometric Surface Lines
- 4.76 MW 12S
Monitoring Well with water level elevation



0 25 50 100 Feet

Figure 4-8
Potentiometric Surface Map
Surficial Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- Intermediate Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Potentiometric Surface Lines
- 7.96 Monitoring Well with Water Level Elevation MW 11M

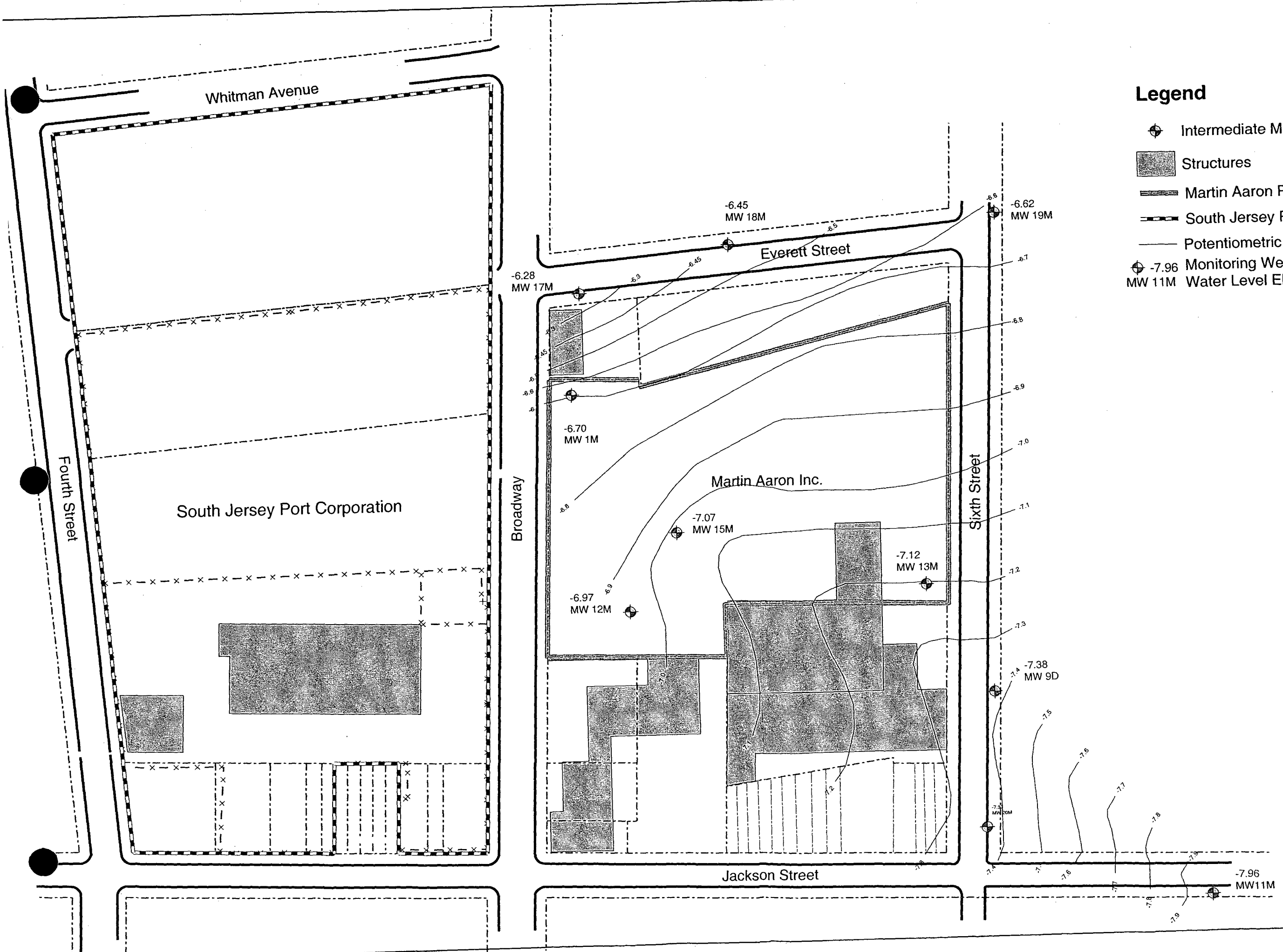


Figure 4-9
Potentiometric Surface Map
Intermediate Upper PRM Aquifer
June 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- Intermediate Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Potentiometric Surface Lines
- Monitoring Well

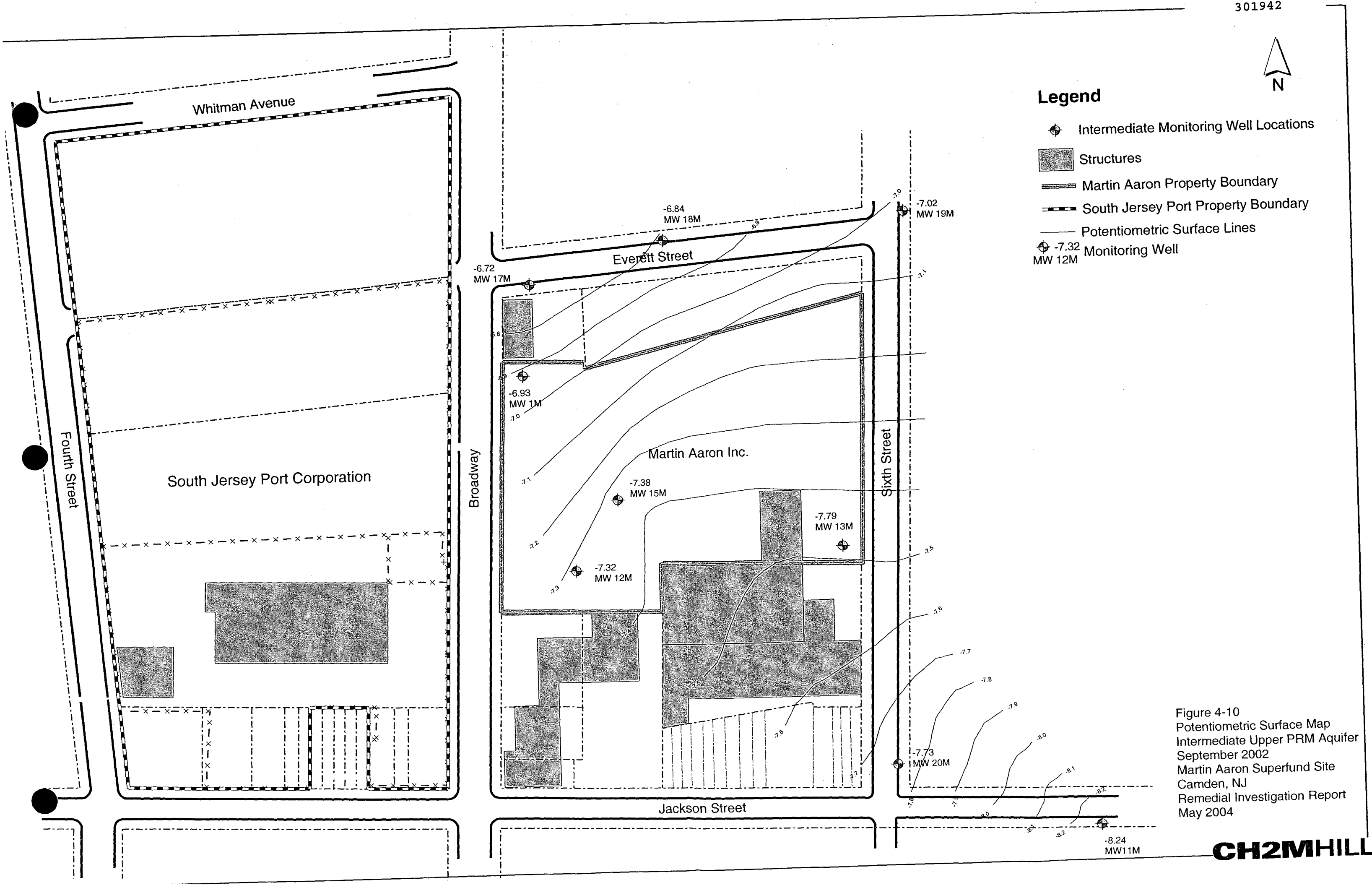


Figure 4-10
Potentiometric Surface Map
Intermediate Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

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5. Nature and Extent of Contamination

This section presents the nature and extent of contamination in the soil (surface and subsurface) and groundwater at the Site. The Site is defined as the Martin Aaron property, SJPC, Comarco Products, the Ponte Company, the scrapyards, and extends to Everett Street and Sixth Street. The RI evaluated the presence of contamination at the Site resulting from former drum recycling operations conducted at Martin Aaron. The investigation of soil and groundwater at SJPC, Comarco Products, the scrapyards, and Ponte, which is adjacent to the backyards of the residences on Jackson Street, was conducted in order to determine if contaminants from Martin Aaron had migrated to the surrounding properties. The soil and groundwater investigation at SJPC was also conducted to determine if contamination was present at SJPC as a result of former drum storage activities at SJPC, performed under a lease agreement with Martin Aaron.

The sampling and analytical procedures for soil and groundwater are found in Sections 3.1 and 3.2. Soil and groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals and cyanide, and pesticides/PCBs.

The nature of contaminants is determined by the presence of compounds at concentrations greater than the applicable criteria, or screening level. The screening levels for soil and groundwater are defined in Sections 5.2.1 and Section 5.2.2 below. The extent of contamination is determined by evaluating contaminant levels in areas of former Martin Aaron drum recycling activities, and the properties surrounding Martin Aaron.

In this section, the results are presented by groups of compounds (VOCs, SVOCs, metals, and pesticides/PCBs) according to media (surface soil, subsurface soil, and groundwater). Compounds identified at detectable concentrations during this RI, are presented and discussed as concentration ranges and maximum concentrations detected. Compounds identified at concentrations greater than the appropriate screening levels are defined as Constituents of Concern (COCs). COCs identified during this RI, and the previous RI, are provided in this section.

Tables 5.3-1 through 5.3-5 list constituents identified in soil at detectable concentrations, and the frequency of those detections, during this RI and the previous NJDEP RI. These tables show that the frequency of detection of certain compounds has changed since the March 2002 RI. Soil data obtained during this RI are represented in Figures 5-1 through 5-44. Remedial actions conducted since the previous RI have impacted the nature and extent of soil contamination at the Site, therefore, the NJDEP soil data is not represented in figures in this RI Report.

5.1 Data Quality and Presentation

One hundred thirty-five soil samples and three hundred sixty-eight water samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs and inorganic parameters under the contract laboratory program (CLP) including QA/QC samples. As described in Section

3.2.6, QA/QC samples were collected to aid in the assessment of data quality. The QA/QC samples collected were field duplicates, MS/MSDs, equipment blanks, and trip blanks.

The data were reviewed by EPA to assess the accuracy, precision, and completeness using the criteria established in the National Functional Guidelines for Data Review. Standard data qualifiers were added by EPA when the QA/QC data indicated a bias. All of the data validation reports were within the applicable National Functional Guidelines for Data Review. Data qualifiers were added by the EPA when the QA/QC data indicated a bias.

Standard data qualifiers were used as a means of classifying the data as to their conformance to QA/QC requirements. The data qualifiers are defined as follows:

- [U] The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
- [J] The associated value is an estimated quantity. Used when the data indicated the presence of a component was below the stated reporting limit, or when the direction of analytical bias was unknown.
- [UJ] The component was analyzed for, but not detected at a level equal to or greater than the reporting limit. This flag was used when QA/QC data indicated a low bias in the analytical data.
- [R] Rejected. The data is of insufficient quality to be deemed acceptable as reported or otherwise qualified.

All of the validation reports reviewed were found to fall within applicable National Functional Guidelines for Data Review. Completeness of analytical data was assessed for compliance with the amount of data required for decision making. The completeness goal for the project data is 95 percent. Qualified data, if not rejected, can still be used to make project decisions and is considered to be compliant data. The percent completeness for the soil data was 98 percent, and 96 percent for the groundwater data. Thus, the data completeness goal stated in the Quality Assurance Project Plan, in Appendix H, was met for each sampling event.

For organic compounds in soil, the electronic data from the laboratory was submitted in units of $\mu\text{g}/\text{kg}$ and was entered into the Environmental Quality Information System (EQulS) database. Inorganic soil results were submitted in mg/kg . In order to maintain consistency with the data submission from the laboratory and the database, organic soil results are presented in units of $\mu\text{g}/\text{kg}$, and inorganics in mg/kg , in the data tables in this section. However, concentration units used for the figures are in mg/kg for organic and inorganic compounds. In order to convert from $\mu\text{g}/\text{kg}$ to mg/kg , $\mu\text{g}/\text{kg}$ is multiplied by 0.001. To convert from mg/kg to $\mu\text{g}/\text{kg}$, mg/kg is multiplied by 1000. All groundwater results including MCLs and NJ GWQC are presented in $\mu\text{g}/\text{L}$.

5.2 Extent of Soil Contamination

The screening levels used to evaluate the analytical results for soil and groundwater samples were conservatively selected from NJDEP and EPA criteria.

5.2.1 Soil Screening Levels

Soil concentrations were screened against the NJDEP Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC), the NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC), and the EPA Soil Screening Level (SSL) Migration to Groundwater at Dilution Attenuation Factor 20 (DAF 20) for each compound. Since Martin Aaron is an industrial site and future use of the site is also likely to be industrial, the EPA determined that constituents should be screened against the NRDCSCC, IGWSCC, and the EPA SSL. In cases where a compound did not have a value specified from either of these soil criteria sources, the lowest of the following three criteria were selected: NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC), EPA Ingestion, and EPA Inhalation. The NJDEP RI identified constituents exceeding the RDCSCC, the NRDCSCC, and the IGWSCC.

5.2.2 Groundwater Screening Levels

Groundwater concentrations were compared to the NJDEP GWQC and the EPA Maximum Contaminant Limit (MCL) for each compound. The NJDEP RI identified constituents exceeding the NJ GWQC.

5.3 Distribution of Soil Contamination

5.3.1 Surface Soils

Surface soil sampling locations are shown on Figure 3-1. Soil borings installed during this RI have an "SB" designation. Soil borings installed during the NJDEP RI have an "SO" designation. The distribution of surface sample locations are as follows:

- 24 samples on the Site, or within the Martin Aaron property;
- 15 samples at SJPC located across from Martin Aaron at 1535 South Broadway;
- 4 samples at the scrapyard located on Everett Street between Broadway and Sixth Street;
- 2 samples on the right-of-way on Everett Street across from the scrap yard;
- 7 samples on the right-of-way on Sixth Street adjacent to Martin Aaron;
- 3 samples on the Comarco Products property; and
- 5 samples on the Ponte property on Sixth Street adjacent to the residences on Jackson Street.

As described in Section 3.1.2, surface soil samples were collected from 0 to 2 feet below grade. The goal was to collect the upper 6 inches of the soil profile. However, at several sampling locations the upper 6 inches of material consisted mainly of asphalt and/or concrete. Therefore, at these locations, the sample was collected from the soil immediately beneath the concrete or asphalt material. Actual sample depths, analytical results, and dates of sampling, for the surface soil samples are provided in Tables 5-1 through 5-4. These tables provide those results that exceed the screening levels. The full set of surface soil data is provided in Appendix G.1 through G.5.

5.3.1.1 VOCs

VOCs were detected at 55 of the 60-three surface soil sampling locations identified above. VOCs were detected in all soil samples collected from the Martin Aaron property. There were only a few VOC detections in samples collected from the northern portion of the SJPC property.

As presented in Table 5-1, and shown on Figure 5-1, compounds detected above screening criteria which are COCs in soil, include: benzene, chloroform, chlorobenzene, 1,1-dichloroethane (DCA), cis-1,2 dichloroethylene (DCE), methylene chloride, tetrachloroethylene (PCE), trichloroethylene (TCE), 1,2,3-trichlorobenzene, 1,1,1-trichloroethane (TCA), toluene, and vinyl chloride. Soil samples with VOCs exceeding the screening levels were all found on the Martin Aaron property. The list of compounds which were present at detectable concentrations, in addition to the COCs, include: acetone, bromoform, bromomethane, carbon disulfide, chloroethane, cyclohexane, 1,2-dichlorobenzene, trans-1,2-dichloroethene, 1,1-dichloroethylene, ethylbenzene, methyl cyclohexane, methyl ethyl ketone, methyl isobutyl ketone, 1,1-trichloroethane, isopropylbenzene, styrene, 2-hexanone, and isopropyl benzene.

Figures 5-2 through 5-5 present isopleth maps for benzene, TCE, PCE, and cis-1,2-DCE. These compounds, which are also COCs, were frequently detected in surface soil at Martin Aaron. Figure 5-2 delineates detectable concentrations of benzene, which was detected at most sampling locations at Martin Aaron at concentrations exceeding EPA SSLs and the IGWSCC. There were no detectable concentrations of benzene on the other properties at the Site. Figure 5-3 delineates detectable concentrations of TCE, which is present at concentrations exceeding the EPA SSLs and IGWSCC. Figure 5-4 delineates detectable concentrations of PCE, which is present at concentrations above the EPA SSLs, the NRDCSCC, and the IGWSCC. Figure 5-5 delineates detectable concentrations of cis-1,2-DCE, which is present at concentrations exceeding the EPA SSL and the IGWSCC. There were no concentrations of cis-1,2-DCE detected above the NRDCSCC at any sample location throughout the site. There was only one sampling location outside of Martin Aaron, in the scrapyard, with a detectable level of cis-1,2-DCE, which did not exceed any screening criteria. On Martin Aaron, cis-1,2-DCE concentrations were present above the EPA SSL and the IGWSCC.

VOCs including cis-1,2-DCE, PCE, and TCE were found at concentrations two or more orders of magnitude above the screening level in at least one sample. As shown on Figure 5-5, cis-1,2-DCE concentrations ranged from non-detectable (ND) to 24 mg/kg. The highest concentration of cis-1,2-DCE was detected at sample location SB-31 located near the former Martin Aaron Building, and former UST area (Figure 2-1). As shown on Figure 5-3, TCE concentrations ranged from ND to 60 mg/kg. The highest TCE concentration was also detected at sample location SB-31. PCE was the compound detected most frequently among the VOCs in surface soil. PCE concentrations ranged from ND to 26 mg/kg. The highest concentration of PCE was also detected at sample location SB-31. As shown on Figure 5-2, benzene concentrations ranged from ND to 4.5 mg/kg. The highest concentration was detected at sample location S0-201 located near former Sewer Basin 4 (Figure 2-1).

In general, the highest VOC concentrations were detected at sample locations SB-31 and SB-60. These sample locations are near the former Martin Aaron Building and former UST

areas shown in Figure 2-1. This area was used for drum cleaning operations and was identified as a source area of VOC contamination during the NJDEP RI. Numerous VOCs including: benzene, PCE, TCE, cis-1,2-DCE, 1,2,4-trichlorobenzene, and chloroform, were also elevated at sampling location SO-201 located in the southeastern portion of the Site. Based on the NJDEP RI Report, this was also a source of contamination from former drum recycling operations.

As shown in Table 5.3-1 below, the VOCs detected in surface soils during this RI are consistent with the NJDEP RI. PCE and TCE were detected in greater than half of the samples collected during both RIs. Other constituents detected above screening levels during both investigations include cis-1,2-DCE, chlorobenzene, 1,1-DCE, chloroform, and toluene.

COCs identified in surface soil which were not found during the NJDEP RI include 1,1,1-TCA, vinyl chloride, methylene chloride, and 1,2,4-trichlorobenzene. COCs no longer detected above screening levels in surface soil include 1,2-DCE, 1,2-dichloropropane, acetone, styrene, and xylene.

The criteria used to screen for VOCs during this RI are equal to or more stringent than the NJDEP IGWSCC for all compounds. The IGWSCC is the most stringent of the NJDEP soil cleanup criteria for VOCs. Table 5.3-1 below shows all of the VOCs detected above screening levels, and those detected above screening levels in greater than half of the samples analyzed during both RIs.

TABLE 5.3-1
Surface Soil – Constituents of Concern
Volatile Organic Compounds

VOCs	Current RI		NJDEP RI	
	Detected Above Screening Levels	Frequently Detected Above Screening Levels	Detected Above Screening Levels	Frequently Detected Above Screening Levels
Tetrachloroethylene	X	X	X	X
Trichloroethylene	X	X	X	X
Cis-1,2-dichloroethylene	X	X	X	
1,1,1-trichloroethane	X			
Vinyl chloride	X	X		
Chlorobenzene	X		X	
1,1-dichloroethane	X		X	
Methylene chloride	X			
Chloroform	X		X	
1,2,4-trichlorobenzene	X			
Benzene	X	X		
Toluene	X		X	X

TABLE 5.3-1
Surface Soil – Constituents of Concern
Volatile Organic Compounds

VOCs	Current RI		NJDEP RI	
	Detected Above Screening Levels	Frequently Detected Above Screening Levels	Detected Above Screening Levels	Frequently Detected Above Screening Levels
1,2-dichloroethene			X	
1,2-dichloropropane			X	
Acetone			X	
Styrene			X	X
Xylene			X	X

Note: Frequently detected compounds were identified in greater than half of the total samples analyzed.

5.3.1.2 SVOCs

SVOCs were detected at 58 of the 60 surface soil sampling locations. Unlike the VOCs, the SVOC analytical results above screening levels were not limited to Martin Aaron, but were distributed to the south of the property, and at SJPC. SVOCs did not exceed screening levels in surface soil samples collected to the north of Martin Aaron at the scrapyard, Everett Street, or Sixth Street sampling locations. SVOCs were generally distributed across the Martin Aaron property, with most concentrations above screening levels focused in areas of former drum recycling operations. SVOCs identified above screening levels at SJPC were primarily situated on the western portion of the property.

As presented in Table 5-2, and shown on Figure 5-6, the soil samples with SVOCs exceeding the screening levels were found at the Martin Aaron property, SJPC, Comarco Products, and the Ponte property. The SVOCs detected above screening levels include:

benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, n-nitrosodiphenylamine, pentachlorophenol, and pyrene. As shown in Table G.2 of Appendix G, SVOCs were also detected below screening levels. SVOCs detected at levels almost two orders of magnitude above the screening level included: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and carbazole. The isopleth maps for these SVOCs are shown on Figures 5-7 through Figure 5-10. Figure 5-7 delineates benzo(a)anthracene concentrations above 1 mg/kg. Detectable concentrations of benzo(a)anthracene which do not exceed screening levels are also shown on Figure 5-7. Benzo(a)anthracene concentrations exceed the EPA SSL and the NRDCSCC at Martin Aaron, SJPC, Ponte, and Comarco Properties. Figure 5-8 delineates benzo(a)pyrene concentrations above the NRDCSCC of 0.66 mg/kg. There were detectable concentrations of benzo(a)pyrene at most sampling locations at Martin Aaron, Ponte, SJPC, Comarco, and the scrapyard. Figure 5-9 delineates benzo(b)fluoranthene concentrations above 1 mg/kg. There were detectable levels of benzo(b)fluoranthene at most sampling locations at Martin Aaron, Ponte, and SJPC.

Benzo(b)fluoranthene levels were elevated above the EPA SSL in suspected source areas at Martin Aaron and SJPC properties. Figure 5-10 delineates carbazole concentrations above the EPA SSL of 0.6 mg/kg. There were detectable concentrations of carbazole at Martin Aaron, Ponte, and SJPC. There are no NRDCSCC or IGWSCC criteria for carbazole.

As shown on Figure 5-7 and in Table G.2 of Appendix G, benzo(a)anthracene concentrations ranged from ND to 120 mg/kg. The highest concentration was detected at sample location SB-02. As shown on Figure 5-8 and Table G.2 of Appendix G, benzo(a)pyrene concentrations ranged from ND to 110 mg/kg. The highest concentration was also detected at sample location SB-02. As shown on Figure 5-9, benzo(b)fluoranthene concentrations ranged from ND to 110 mg/kg. The highest concentration was also detected at sample location SB-02. As shown on Figure 5-10 and Table G.2 of Appendix G, carbazole concentrations ranged from ND to 14 mg/kg. The highest concentration was detected at sample location S0-301 at SJPC. Other SVOCs detected above screening levels are presented in Table 5-2 and Table G.2 of Appendix G. Dibenz(a,h)anthracene concentrations ranged from ND to 19 mg/kg. The highest concentration was also detected at sample location SB-02. Fluoroanthene concentrations ranged from ND to 290 mg/kg. The highest concentration was also detected at sample location SB-02. Indeno(1,2,3-cd)pyrene concentrations ranged from ND to 59 mg/kg. The highest concentration was also detected at sample location SB-02. The only detection of n-nitrosodiphenylamine was at sampling location SO-201, at a concentration of 1.3 mg/kg. The only detection of pentachlorophenol, was at sampling location SB-31, at a concentration of 1.1 mg/kg. Pyrene concentrations ranged from ND to 230 mg/kg with the highest concentration detected at sample location SB-02.

In general, the greatest number of SVOCs, at the highest concentrations, were PAHs detected at sample locations SB-02, SB-56, and SB-112 on the western portion of the Martin Aaron property, SB-06 on the northern portion of Martin Aaron, SB-118 and SB-124 on the western side of the Rhodes Drum Building, SO-404 on the Ponte property, and SB-85 at Comarco Products.

Sample location SB-02 is located in the area of the former Martin Aaron Building where former drum recycling operations occurred, and trenches, aboveground storage tanks, and sewer basins were located. Sample location S0-301 is located on the western edge of SJPC. These SVOCs were primarily detected in the former areas of drum operations in the western and southeastern portions of the property. Figure 2-1 shows the former Martin Aaron Building, and surrounding trenches and sewer basins in the western portion of the property. The former (aboveground or underground) storage tanks and Sewer Basin 4 were located in the southeastern portion of the property.

As shown on Table 5.3-2 below, SVOCs detected most frequently at concentrations above screening levels during both RIs include benzo(a)anthracene and benzo(b)fluoranthene. Other SVOCs detected, though not as frequently, during both investigations include: dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene.

SVOCs currently identified in surface soil which were not detected above screening levels during the NJDEP RI include: fluoranthene, n-nitrosodiphenylamine, and pyrene. Pentachlorophenol was detected above the screening level during this RI, but was not

analyzed during the NJDEP RI. The areas of the highest SVOC concentrations are similar for both RIs.

The criteria used to screen for SVOCs during this RI are not as stringent for the COCs as the NJDEP RDCSCC used during the NJDEP RI. However, the direct contact exposures to surface soil have been evaluated as part of the human health risk assessment.

TABLE 5.3-2
Surface Soil – Constituents of Concern
Semi-Volatile Organic Compounds

SVOCs	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Benzo(a)anthracene	X	X	X	X
Benzo(a)pyrene	X		X	X
Benzo(b)fluoranthene	X	X	X	X
Benzo(k)fluoranthene	X		X	X
Carbazole	X	X	NC	NC
Dibenzo(a,h)anthracene	X		X	
Fluoranthene	X			
Indeno(1,2,3-cd)pyrene	X		X	
N-nitrosodiphenylamine	X			
Pentachlorophenol	X		NA	NA
Pyrene	X			

Notes:

Frequently detected compounds were identified in greater than half of the total samples analyzed.

NC - No Criteria

NA - Not Analyzed

5.3.1.3 Metals

Metals were detected in each of the 60 surface soil samples.

As presented in Table 5-3 and shown on Figures 5-11, metals concentrations greater than screening levels were distributed throughout all of the properties sampled including Martin Aaron, Comarco Products, the Ponte property (behind residences), the scrapyard, and the right-of-ways on Everett Street and Sixth Street. As presented in Table 5-3, and shown on Figure 5-12, the metals concentrations greater than screening levels were identified at SJPC. Metals were distributed across the SJPC property with slightly more elevated levels found in samples collected on the northwestern and southwestern portions of the SJPC property. More metals constituents were found on the Martin Aaron property, and the surrounding properties than at SJPC.

As shown on Table G.3 of Appendix G, individual metals encountered above screening levels include: antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Aluminum, antimony, beryllium, iron, magnesium, manganese, and vanadium were also present above detection limits. The most prevalent metals detected include: arsenic, barium, and lead. Figures 5-13 through 5-15 provide the isopleth maps delineating the distribution of these compounds. Figure 5-13 delineates arsenic to concentrations above the NRDCSSC of 20 mg/kg. There were detectable levels of arsenic at all sampling locations on Martin Aaron, SJPC, Comarco, Ponte, and the scrapyard. The highest levels of arsenic were also found in the suspected source areas at the Martin Aaron property. Figure 5-14 delineates barium concentrations to levels above the EPA SSL of 1600 mg/kg. Concentrations exceeding 5,000 mg/kg are found at Martin Aaron, SJPC, Comarco, Ponte, and the scrapyard. The highest concentrations are found along Sixth Street. Figure 5-15 delineates lead concentrations above the EPA SSL and the NRDCSSC. The highest concentrations of lead are found in proximity to a known source area in the central portion, and along the eastern side of the Martin Aaron property (at SB-31). Elevated lead levels above 600 mg/kg were found at four locations at the SJPC property. Several sample locations at the scrapyard, Everett Street, along Sixth Street, and on the Ponte property also exhibited elevated lead concentrations. The location of the elevated lead concentrations suggests a potential influence from an off-site source to the east of the Martin Aaron property. A metals recycling plant is located on Sixth Street east of the Martin Aaron property. Lead and other metals are also known to be naturally occurring in the vicinity of the Site.

The ranges in concentrations for metals, and the corresponding sampling location are provided below in Table 5.3-3.

TABLE 5.3-3
Surface Soil - Metals
Ranges of Concentrations

Metals Constituent	Low Concentration (mg/kg)/Sampling Location	Maximum Concentration (mg/kg)/Sampling Location
Antimony	0.81/SB-66(SJPC)	37.2/SB-208(Everett St.)
Arsenic	2.1/SO-210(Scrapyard)	766/SB-60(M.A.)
Barium	18.5/SB-42(M.A.)	30,800/SB-81(M.A.)
Cadmium	0.27/SO-207(6 th St.)	110/SB-31(M.A.)
Chromium	8.5/SB-71 (SJPC)	1080/SB-124 (M.A.)
Copper	4/SB-42 (M.A.)	1400/SB-130 M.A.)
Lead	8.3/SB-42 (M.A.)	112,000/SO-209 (Everett St.)
Mercury	0.07/SB-71 (SJPC)	7.7/SO-208 (Everett St.)
Nickel	1.5/SB-42 (M.A.)	576/SB-31 (M.A.)
Selenium	0.99/SO-207 (M.A.)	5.9/SO-208 (Everett St.)
Silver	0.23/SO-403 (Ponte)	45.7/SB-31 (M.A.)
Zinc	9.9/SB-42 (M.A.)	23,900/SO-208 (Everett St.)

TABLE 5.3-3
Surface Soil - Metals
Ranges of Concentrations

Metals Constituent	Low Concentration (mg/kg)/Sampling Location	Maximum Concentration (mg/kg)/Sampling Location
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Note: M.A. – Martin Aaron Property

There were two detections of thallium at concentrations of 3.9 mg/kg and 6.4 mg/kg. These concentrations were both detected in samples collected from the right-of-way on Everett Street.

During the NJDEP RI, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, and zinc were found at levels above the NJDEP RDCSCC and NRDCSCC. As shown in Table 5.3-4 below, arsenic and barium were detected in greater than half of the surface samples collected during both investigations. As stated above, arsenic concentrations ranged from 2.1 mg/kg to 766 mg/kg during this RI. The range of arsenic concentrations was 3.1 mg/kg to 1640 mg/kg during the NJDEP RI. Barium concentrations ranged from 18.5 mg/kg to 30,800 mg/kg during this RI. The range of barium concentrations was 0.66 mg/kg to 25,300 mg/kg during the NJDEP RI. Lead was also detected at levels greater than screening levels in over half of the samples.

With the exception of a few metals (arsenic, barium, beryllium, cadmium) the criteria used to screen COCs during this RI were equal to, or more stringent than the NJDEP criteria used to screen data during the NJDEP RI. Direct contact exposures will be evaluated as part of the human health risk assessment. Table 5.3-4 below shows all of the metals detected above screening levels, and those detected above screening levels in greater than half of the samples analyzed during both RIs.

TABLE 5.3-4
Surface Soil – Constituents of Concern
Metals

Metals	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Antimony	X		X	X
Arsenic	X	X	X	X
Barium	X	X	X	
Beryllium			X	
Cadmium	X		X	
Chromium	X		X	
Copper	X		X	
Lead	X	X	X	
Mercury	X			

TABLE 5.3-4
Surface Soil – Constituents of Concern
Metals

Metals	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Nickel	X			
Selenium	X			
Silver	X			
Thallium	X			
Zinc	X		X	

Note: Frequently detected compounds were identified in greater than half of the total samples analyzed.

5.3.1.4 Pesticides/PCBs

Pesticides were detected in 51 of the 60 surface soil samples. As shown in Table G.4 of Appendix G, at least one pesticide compound, primarily dieldrin or 4,4-DDE, was detected in most surface soil samples collected from the Martin Aaron property.

As presented in Table 5-4 and as shown on Figure 5-16, constituents with concentrations above screening levels include aldrin, alpha-BHC, beta-BHC, gamma-BHC, and dieldrin. Constituents above screening levels were found on the Martin Aaron property, one sample location on the right-of-way on Everett Street (SO-208), two locations on the right-of-way on Sixth Street (SB-106, SB-108), and one location at Comarco Products (SO-204). No pesticide compounds exceeded the screening levels in surface soil samples collected from SJPC. Figures 5-17 through 5-19 present isopleth maps for aldrin, dieldrin, and 4,4-DDE. As shown on Figure 5-17, aldrin was found above the EPA SSL and NRDCSCC at one location at Martin Aaron. Figure 5-18 delineates dieldrin concentrations above the EPA SSL of 0.004 mg/kg. There were also levels of dieldrin above the NRDCSCC at two locations on Martin Aaron. Figure 5-19 delineates detectable concentrations of 4,4-DDE. There were no concentrations above the NRDCSCC of 50 mg/kg and there is no EPA SSL or IGWSCC for 4,4-DDE. However, 4,4-DDE was found above 0.1 mg/kg at most sampling locations at Martin Aaron. It was also present at Comarco, the scrapyard, and SJPC.

As shown in Table 5-4, aldrin concentrations ranged from 2.6 µg/kg to 1300 µg/kg. The highest concentration was detected at SB-60, which is located in an area of former drum recycling activities at Martin Aaron. There were two concentrations of beta-BHC above screening levels, 3.8 µg/kg and 37 µg/kg. The highest concentration of beta-BHC was 37 µg/kg, and was also found in the sample collected from SB-60. Dieldrin concentrations ranged from 3.5 µg/kg to 1300 µg/kg. The highest concentration was detected at SB-124, which is located in an area of former drum recycling activities at Martin Aaron.

The NJDEP RI identified three pesticide compounds exceeding either the RDCSCC, or the NRDCSCC. These compounds included: aldrin, dieldrin, and 4,4,4-DDE. No pesticides exceeded the IGWSCC.

With the exception of aldrin, the criteria used to screen pesticides during this RI were equal to, or more stringent than the NJDEP criteria used to screen data during the NJDEP RI. Direct contact exposures will be evaluated as part of the human health risk assessment. Table 5.3-5 shows all of the pesticides detected above screening levels, and those detected above screening levels in greater than half of the samples analyzed during both RIs.

As shown in Table 5-8, PCBs (Aroclor 1254 and Aroclor 1260), were detected at or above the NRDCSCC at five surface soil sampling locations including SB-08, SB-118, SB-60, SO-201, and SO-204. These soil sampling locations are all on the Martin Aaron property with the exception of SO-204 which is located on the Comarco property. There were no PCBs present in surface soil above the IGWSCC or EPA SSLs at the Site.

TABLE 5.3-5
Surface Soil – Constituents of Concern
Pesticides and PCBs

Pesticides and PCBs	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Aldrin	X		X	
Beta-BHC	X		NC	NC
Dieldrin	X	X	X	
4,4,4-DDE			X	
PCB-Aroclor 1254/1260	X		X	

Notes:

Frequently detected compounds were identified in greater than half of the total samples analyzed.

NC - No Criteria

5.3.2 Subsurface Soils

Soil boring locations are shown on Figure 3-1. The distribution of soil samples is as follows:

- 29 samples on the Martin Aaron property;
- 18 samples at SJPC located across from Martin Aaron at 1535 South Broadway;
- 4 samples at the scrapyard located on Everett Street between Broadway and Sixth Street;
- 4 samples on Everett Street;
- 7 samples on Sixth Street adjacent to Martin Aaron;
- 3 samples on the Comarco Products property;
- 2 samples on Sixth Street away from Martin Aaron (northeast and southeast); and

- 5 samples on the Ponte property on Sixth Street adjacent to the residences on Jackson Street.

As described in Section 3.1.3, subsurface soil samples were collected from depths ranging from two to twenty-one feet bgs.

5.3.2.1 VOCs

VOCs were detected in 56 of the 72 subsurface soil samples collected from the Site. As shown in Table 5-5 and on Figure 5-20, the soil screening levels for VOCs were exceeded at sixteen subsurface soil sampling locations. All of the sampling locations with subsurface soil results above screening levels were within the Martin Aaron property boundary except one elevated level of benzene at MW-18S, which is located on the right-of-way on Everett Street to the north of Martin Aaron. The VOCs above screening levels include benzene, bromomethane, chloroform, 1,1-DCE, cis-1,2-DCE, ethyl-benzene, methylene chloride, toluene, 1,2,4-trichlorobenzene, 1,1,1-TCA, TCE, PCE, vinyl chloride, and xylene.

Figures 5-21 through 5-23 provide isopleth maps of total VOCs at depths ranging from 4-5.5' bgs, 6-7' bgs and at 7-21' bgs. As shown on Figure 5-21, total VOCs concentrations above 500 mg/kg are found at most sampling locations at the 4-5.5' sample interval. There are three locations where total VOCs are elevated above 100,000 mg/kg. One location is adjacent to the Rhodes Drum building in a former source area and the other location is in the (southern) portion of the Martin Aaron property. Figure 5-22 delineates total VOC at a depth of 6-7' bgs exceeding 500 mg/kg, 1,500 mg/kg, 2,000 mg/kg, and 100,000 mg/kg. The highest total VOC concentration of 141,970 mg/kg is located on Martin Aaron, near a former source area at sample location SB-60. Figure 5-23 delineates total VOCs at a depth of 7' to 21' bgs. The entire Martin Aaron property, most of the SJPC, and the scrapyard exceed 500 mg/kg total VOCs in samples from 7 to 21 feet below grade. The highest total VOC concentration is found on Martin Aaron at 6,372 mg/kg near a former source area.

Figures 5-24, 5-25, and 5-26 show the cross sections presenting lateral profiles of the VOC results exceeding screening levels in the subsurface soil samples. Chlorinated VOCs including: PCE, TCE, cis-1,2-DCE, 1,1,1-TCA, vinyl chloride, 1,1-DCE, methylene chloride, chloroform, and 1,2,4-trichlorobenzene were all detected above screening levels. Petroleum aromatic hydrocarbons including benzene, toluene, ethylbenzene and bromomethane were also present above their respective screening levels.

The ranges of concentrations for VOCs, and the corresponding sampling location, are provided below in Table 5.3-6.

TABLE 5.3-6
Subsurface Soil Volatile Organic Compounds
Ranges of Concentrations

VOC Constituent	Low Concentration (mg/kg)/Sampling Location	Maximum Concentration (mg/kg)/Sampling Location
Tetrachloroethylene	2/SO-209 (Everett St.)	110,000/SB-47(M.A.)
Trichloroethylene	1/MW-13S (M.A.)	630,000/SB-11 (M.A.)
Cis-1,2-Dichloroethene	2/SB-131,SB-42 (M.A.)	13,000/SB-11 (M.A.)

TABLE 5.3-6
Subsurface Soil Volatile Organic Compounds
Ranges of Concentrations

VOC Constituent	Low Concentration (mg/kg)/Sampling Location	Maximum Concentration (mg/kg)/Sampling Location
	SO-213 (Scrapyard)	
1,1,1-Trichloroethane	2/SB-08 (M.A.)	3300/SO-201 (M.A.)
Vinyl Chloride	12/SB-122 (M.A.)	480/SB-11 (M.A.)
Methylene Chloride	43/SB-124 (M.A.)	140/MW-12S (M.A.)
Chloroform	5/MW-16S (M.A.)	16,000/SO-201 (M.A.)
Trans-1,2-Dichloroethene	1/MW-16S (M.A.)	1600/SB-11 (M.A.)
Benzene	1/MW-15S (M.A.)	31,000/SO-201(M.A.)
Toluene	1/SO-202 (Ponte)	49,000/SO-201(M.A.)

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As shown on Figure 5-20, PCE, TCE, and benzene were the compounds detected most frequently among the VOCs in subsurface soil. The elevated VOCs are located in areas of drum operations including the western and southeastern portions of the property. As shown on Table 5-5 and Figure 5-20, three constituents, 1,1-DCE, 1,2,4-trichlorobenzene, and bromomethane were each found above screening levels at one location. 1,1-DCE was found at SB-11 (4'-5.5' bgs) at a concentration of 0.13 mg/kg. 1,2,4-trichlorobenzene was found at SO-201 (4'-5.5' bgs) at a concentration of 14 mg/kg. Bromomethane was present at SB-06 (4'-5.5' bgs) at a concentration of 0.52 mg/kg. The highest VOC concentrations in subsurface soil were detected at SB-11 and SO-201 in former operational areas of the property.

During the NJDEP RI, fifteen VOCs were detected at concentrations exceeding the NJDEP IGWSCC in subsurface soil samples including: 1,2-DCE, PCE, TCE, 1,1-DCA, 1,2-DCE, 2-butanone, ethylbenzene, vinyl chloride, benzene, chlorobenzene, chloroform, cis-1,2-DCE, methylene chloride, toluene, and xylene. A comparison of the NJDEP RI to this RI for VOCs in subsurface soil is presented in Table 5.3-7 below.

TABLE 5.3-7
Subsurface Soil – Constituents of Concern
Volatile Organic Compounds

VOCs	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Tetrachloroethylene	X	X	X	
Trichloroethylene	X		X	
Cis-1,2-dichloroethylene	X		NA	

TABLE 5.3-7
Subsurface Soil – Constituents of Concern
Volatile Organic Compounds

VOCs	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
1,1,1-trichloroethane	X			
Vinyl chloride	X		X	
Chlorobenzene			X	
1,1-dichloroethane	X			
Methylene chloride	X		X	
Chloroform	X		X	
1,2,4-trichlorobenzene	X		NA	
Benzene	X		X	
Toluene	X		X	
Trans-1,2-dichloroethene	X		X	
Bromomethane	X		NA	
Ethylbenzene	X		X	
Xylene	X		X	
2-butanone			X	

Notes:

Frequently detected compounds were identified in greater than half of the total samples analyzed.

NA - Not Analyzed

5.3.2.2 SVOCs

SVOCs were detected in 63 of the 72 subsurface soil sampling locations. As shown in Table 5-6 and Figure 5-27, the soil screening levels for SVOCs were exceeded at eighteen subsurface soil sampling locations. Unlike the VOC group, the SVOC analytical results greater than screening levels were not limited to the Martin Aaron property and to Everett Street to the north, but were distributed to the east on the right-of-way on Sixth Street, and at SJPC. SVOCs detected above screening levels are benzo(b)fluoranthene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, carbazole, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, n-nitrosodiphenylamine, isophorone, naphthalene, di-n-butyl phthalate, 3,3-dichlorobenzidine, chrysene, and pyrene.

Figures 5-28, 5-29, and 5-30 provide isopleth maps of total SVOCs at depths ranging from 4' – 5.5' bgs, 6'–7' bgs, and 7' – 21' bgs respectively. SVOCs at elevated concentrations are prevalent at the 4' – 5.5' interval across the entire Site. As shown on Figure 5-27, the highest total SVOC concentration represented by the 5,000,000 mg/kg isopleth is located in the northern portion of the SJPC property at sample location SB-75. There was a service station

located adjacent to SJPC which is a suspected source of SVOC contamination. Elevated concentrations of total SVOCs above 300,000 mg/kg were also present on Martin Aaron and the (northwestern) portion of SJPC. Figures 5-31 and 5-32 show the cross sections presenting profiles of the subsurface soil sampling results for SVOCs exceeding screening levels. A summary of the range of SVOCs, and the sampling locations is provided below in Table 5.3-8 for samples collected from depths ranging from 2'-7' bgs.

TABLE 5.3-8
Subsurface Soil Semi-Volatile Organic Compounds
Range of Concentrations

SVOC Constituent	Low Concentration (µg/kg)/Sampling Location	Maximum Concentration (µg/kg)/Sampling Location
Benzo(b)fluoranthene	21/SB-14 (M.A.)	150,000/SB-75 (SJPC)
Benzo(a)anthracene	22/MW-13S (M.A.)	150,000/SB-75 (SJPC)
Benzo(a)pyrene	20/SB-131 (M.A.)	150,000/SB-75 (SJPC)
Benzo(k)fluoranthene	19/SB-47 (M.A.)	140,000/SB-75 (SJPC)
Carbazole	13/SB-112 (M.A.)	68,000/SB-75 (SJPC)
Dibenzo(a,h)anthracene	13/SO-203 (6 th St)	22,000/SB-75 (SJPC)
Fluoranthene	43/SB-131 (M.A.)	420,000/SB-75
Indeno(1,2,3-cd)pyrene	10/MW-13S (M.A.)	68,000/SB-75 (SJPC)
N-nitrosodiphenylamine	18/SB-131 (M.A.)	1700/SB-130 (SJPC)
Isophrone	16/SO-203 (6 th St)	940/SB-09 (SJPC)
Napthalene	16/SB-42 (M.A.)	120,000/SB-60 (M.A.)
Di-n-butyl phthalate	28/SB-130 (M.A.)	130,000/SB-120 (M.A.)
Chrysene	27/SB-14 (M.A.)	180,000/SB-75 (SJPC)
Pyrene	34/SB-131 (M.A.)	350,000/SB-75 (SJPC)

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The subsurface soil sample with the most SVOC exceedances of the screening levels was SB-75 in the northeast corner of the SJPC property. As described above, there is a suspected source of SVOC contamination to the north of SJPC. During the NJDEP RI, twelve SVOCs were measured at concentrations exceeding one or more of the three NJDEP soil cleanup criteria (NRDCSCC, RDCSCC, IGWSCC). Benzo(b)fluoranthene, fluoranthene, naphthalene, pyrene, and acenaphthene each exceeded the IGWSCC. Benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceeded the NRDCSCC and/or RDCSCC. SVOC concentrations in the subsurface were not detected as frequently as in the surface soil samples during either investigation suggesting they are less likely to migrate into the vadose zone. A comparison of the NJDEP RI to the RI for SVOCs in subsurface soil is presented in Table 5.3-9 below.

TABLE 5.3-9
Subsurface Soil – Constituents of Concern
Semi-Volatile Organic Compounds

SVOCs	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Benzo(a)anthracene	X		X	
Benzo(a)pyrene	X		X	
Benzo(k)fluoranthene	X		X	
Carbazole	X		NC	NC
Dibenzo(a,h)anthracene	X		X	
Fluoranthene	X		X	
Indeno(1,2,3-cd)pyrene	X		X	
N-nitrosodiphenylamine	X			
Isophrone	X			
Napthalene	X		X	
Di-n-butyl phthalate	X			
3,3-Dichlorobenzidine	X		NA	
Chrysene	X		X	
Pyrene	X			

Notes:

Frequently detected compounds were identified in greater than half of the total samples analyzed.

NC - No Criteria

NA - Not Analyzed

5.3.2.3 Metals

Similar to the surface soil results, metals were detected in each of the 72 subsurface soil samples. As shown on Table 5-7 and Figure 5-33, soil samples with analytical results greater than screening levels were found at fifty-four sampling locations on the Martin Aaron property, SJPC, the scrapyard, and the right-of-ways on Everett Street and Sixth Street. These metals include antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and thallium. Arsenic and barium were detected most frequently with exceedances of either metal in nearly every sample. Arsenic and barium are common naturally occurring metals associated with background conditions. Metals are also suspected to be associated with the presence of fill material at Martin Aaron and SJPC. There were no detections of metals above screening levels in samples collected at Comarco Products.

As shown on Figure 5-34, metals above screening levels were located across the SJPC property. These metals include antimony, arsenic, barium, cadmium, chromium, lead, and

thallium. Mercury and selenium, which were detected at the Martin Aaron property above screening levels, were not present at SJPC above screening levels.

Figure 5-35 delineates lead concentrations above the EPA SSL of 400 mg/kg at a soil depth of 4-5.5' bgs. There are several areas of lead contamination on the Martin Aaron property, Everett Street, Sixth Street, and SJPC. The highest lead concentrations are found along Sixth Street adjacent to the metals recycling facility. There are also elevated lead levels near former source areas of contamination on the Martin Aaron property at sample locations SB-02, SB-112, and SB-201. The highest lead concentration on the Martin Aaron property is located in the north central portion of the property near the scrapyard. Elevated lead was also found in the central portion of the SJPC property. Figure 5-36 delineates lead concentrations above the EPA SSL in soil at depths from 6'-7' bgs. At this depth, elevated lead was still found near a former source area at the Martin Aaron property at sample location SB-60. A lead concentration above the NRDCSCC of 600 mg/kg was found south of the main building at SJPC. Figure 5-37 shows that elevated lead is still present at depths 7'-21' bgs. The highest concentration at this depth is at the MW-19S sample location on Sixth Street adjacent to the metals recycling plant.

Figures 5-38 and 5-39 show the cross sections presenting profiles of the metals results exceeding screening levels in the subsurface soil samples across the Site. A summary of the range of metals, and the sampling locations is provided below in Table 5.3-10. These samples were collected from depths ranging from 4'-7'.

TABLE 5.3-10
Subsurface Soils Metals
Range of Concentrations

Metals Constituent	Low Concentration (mg/kg)/Sampling Location	Maximum Concentration (mg/kg)/Sampling Location
Antimony	0.9/SB-97 (6 th St)	41/SB-06 (M.A.)
Arsenic	0.74/SO-401 (Ponte)	23,000 (M.A.)
Barium	18.5/MW-14S (M.A.)	39,700/SO-203 (6 th St.)
Cadmium	0.16/SB-78 (SJPC)	291/SB-75 (SJPC)
Chromium	5.6/SO-211 (scrapyard)	21,3000/SB-06 (M.A.)
Copper	2/SO-401 (Ponte)	2590/SB-42 (M.A.)
Lead	2.5/SO-401 (Ponte)	9950/SB-108 (6 th St.)
Mercury	0.05/SO-202 (Ponte)	224/SB-06 (M.A.)
Selenium	1.2/SB-120 (M.A.)	5.2/SB-108 (6 th St.)
Thallium	1.2/MW-14S (M.A.)	1.9/SB-108 (6 th St.)

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During the NJDEP RI, twelve metals were detected at concentrations exceeding the RDCSCC including: arsenic, barium, cadmium, and lead. Metals detected less frequently include: antimony, beryllium, chromium, copper, mercury, nickel, thallium, and zinc. A comparison of the NJDEP RI to this RI for metals in subsurface soil is provided in Table 5.3-11 below.

TABLE 5.3-11
Subsurface Soil – Constituents of Concern
Metals

Metals	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Antimony	X		X	
Arsenic	X		X	X
Barium	X		X	X
Beryllium			X	X
Cadmium	X		X	X
Chromium	X			
Copper			X	
Lead			X	X
Mercury			X	
Nickel			X	
Selenium				
Silver				
Thallium			X	
Zinc			X	

Note: Frequently detected compounds were identified in greater than half of the total samples analyzed.

5.3.2.4 Pesticides/PCBs

Similar to the VOCs and as shown in Table 5-8 and Figure 5-40, pesticides were detected in 48 of the 72 subsurface soil samples. Similar to the results for the surface soil samples, the subsurface soil samples with pesticide analytical results greater than screening levels were identified on the Martin Aaron property, Everett Street, Sixth Street, and Comarco Products to the south. The five pesticides above screening levels include: dieldrin, alpha-BHC, beta-BHC, gamma-BHC (lindane), and heptachlor epoxide. Figures 5-41 and 5-42 show isopleths of dieldrin concentrations at the Martin Aaron property, Comarco, Sixth Street, the scapyard, and Everett Street. Dieldrin is present in subsurface soil on these properties at levels exceeding the EPA SSLs and the NRDCSCC. As shown on Figure 5-41, dieldrin is found at the highest concentration on the Martin Aaron property and Sixth Street at sample depths from 4'-5.5' bgs. Figure 5-42 shows dieldrin concentrations at sample depths from 7'-21' bgs. There was one area near the former source area at the Martin Aaron property, and another area in the northern portion of the Martin Aaron property and adjacent scapyard with elevated dieldrin concentrations. Figures 5-43 and 5-44 show the cross sections presenting the lateral profiles of the pesticide results exceeding screening levels in

subsurface soil. These figures show that pesticides, primarily dieldrin, occurs most frequently in subsurface soil across the Site.

During the NJDEP RI, three pesticides were measured at concentrations exceeding the RDCSCC and the NRDCSCC including: aldrin, dieldrin, and heptachlor. No pesticide compounds were detected at concentrations in excess of the NJDEP IGWSCC. There were also exceedances of the RDCSCC for total PCBs. A comparison of the NJDEP RI to this RI for pesticides in subsurface soil is provided in Table 5.3-12 below.

As shown in Table 5-8, PCBs (Aroclor 1254 and Aroclor 1260), were detected at or above the NRDCSCC at six subsurface soil sampling locations including MW-14S, SB-08, SB-09, SB-120, SO-201, and SO-204. These sampling locations are all located on the Martin Aaron Property with the exception of SO-204 which is located on the Comarco Property. There were no PCBs present in surface soil above the IGWSCC or EPA SSLs at the Site.

TABLE 5.3-12
Subsurface Soil – Constituents of Concern
Pesticides and PCBs

Pesticides and PCBs	Current RI		NJDEP RI	
	Detected	Frequently Detected	Detected	Frequently Detected
Aldrin			X	
Alpha-BHC	X			
Beta-BHC	X			
Gamma-BHC	X			
Dieldrin	X		X	
Heptachlor Epoxide	X		X	
PCB-Aroclor 1254/1260	X		X	

Note: Frequently detected compounds were identified in greater than half of the total samples analyzed.

5.4 Groundwater

As described in Section 3.2, two rounds of groundwater sampling were conducted as part of this RI. A total of thirty-four groundwater samples were collected from the four aquifer zones at the Site including the - Surficial Upper PRM (Shallow), Intermediate Upper PRM (Middle), Basal Upper PRM (Regional) and Upper Middle PRM (Deep). Figure 3-2 shows the locations of the new and existing monitoring wells.

5.4.1 Surficial Upper PRM (Shallow) Aquifer

As shown on Figure 3-2, 18 groundwater samples were collected from the Surficial Upper PRM Aquifer at the Site including: new and existing monitoring wells on the Martin Aaron property (MW-1S, MW-5S, MW12-S, MW-13S, MW-14S, MW-15S, MW-16S), the right-of-ways on Everett Street and Sixth Street (MW-9S, MW-10S, MW-17S, MW-18S, MW-19S,

MW-20S), on the right-of-way on Jackson Street (MW-11S), and SJPC (MW-4S, MW-8S, MW-21S, MW-22S).

5.4.1.1 VOCs

As shown on Table 5-9, VOCs were detected above screening levels during the June and September 2002 groundwater sampling events. VOCs elevated above screening levels during the two sampling events include benzene, cis-1,2-DCE, 1,2-dichloropropane, PCE, 1,1,1-TCA, TCE, and vinyl chloride. As shown in Table 5-9 and Table G.9 of Appendix G, the maximum concentrations for these compounds for the June and September 2002 sampling events, respectively, are: benzene (150 µg/L - MW-5S, 110 µg/L - MW-5S), cis-1,2-DCE (320 µg/L - MW-14S, 380 µg/L - MW-14S), 1,2-dichloropropane (1.6 µg/L - MW-11M, 1.7 µg/L - MW-11M), 1,1,1-TCA (87 µg/L - MW-16S, 60 µg/L - MW-20S), and vinyl chloride (58 µg/L - MW-12S, 10 µg/L - MW-12S). The highest concentrations of these VOCs were found in the Surficial Upper PRM Aquifer, or shallow aquifer at the Site, with the exception of 1,2-dichloropropane. 1,2-dichloropropane was found at a concentration slightly above the screening criteria in the Middle Upper PRM Aquifer at MW-11M (Figure 5-49).

As shown on Figure 5-45, VOCs in the Surficial Upper PRM Aquifer, during the September 2002 sampling event, were found in monitoring wells on the Martin Aaron property, Everett Street, and Sixth Street. The highest VOC concentrations, particularly for cis-1,2-DCE, TCE, and benzene, were found in groundwater samples collected from monitoring wells MW-5S, MW-15S, MW-12S, and MW-14S, which are located near former source areas of contamination. Figure 5-49 shows VOCs detected above screening levels in the Middle Upper PRM Aquifer. Similar to the Surficial Upper PRM Aquifer, elevated levels of VOCs, primarily benzene, cis-1,2-DCE, and TCE, are found in groundwater at the Martin Aaron property, Everett Street, and Sixth Street. The highest VOC concentrations are also found near former source areas on the Martin Aaron property. Figure 5-51 shows the VOC results for monitoring wells located in the Basal Upper PRM Aquifer. TCE and vinyl chloride were the only VOCs detected above screening levels during the September 2002 sampling event at the Martin Aaron property and Sixth Street monitoring well locations.

VOC concentrations are generally consistent between the June and September 2002 sampling events. Therefore, only the September 2002 results are shown on Figures 5-45, 5-49, and 5-51.

5.4.1.2 SVOCs

SVOCs were detected in six of the eighteen shallow groundwater sampling locations at Martin Aaron, Everett Street, and Sixth Street. There were no SVOCs detected at SJPC wells. As shown on Table 5-10, two SVOCs above screening levels (n-nitrosodiphenylamine, phenol) were detected during the June 2002 sampling event. In September 2002, n-nitrosodiphenylamine and bis(2-chloroethyl)ether were detected above screening levels. As shown on Figure 5-46, n-nitrosodiphenylamine was detected at a concentration of 38 µg/L at MW-1S in the northwestern portion of the property. Bis(2-chloroethyl)ether was detected at MW-9S downgradient, and southeast, of Martin Aaron during September 2002.

5.4.1.3 Metals

Groundwater samples were analyzed for total and dissolved TAL metals. As shown on Table 5-11 for June and September, metals were detected at each of the eighteen shallow groundwater sampling locations. The metals occurring above screening levels include aluminum, antimony, arsenic, barium, cadmium, chromium, iron, lead, manganese, sodium, and thallium. Chromium was detected above screening levels during the June 2002 event, but not detected during the September event. Thallium was not detected above screening levels in June, but was detected in September. Otherwise, the contaminants and range of concentrations are similar for the June and September 2002 sampling events. Below is a summary of the maximum detected concentrations identified during the September 2002 sampling event. The September data is represented on Figure 5-47. A summary of the maximum concentration of metals detected in the Surficial Upper PRM Aquifer, and their sampling locations is provided below in Table 5.4-1.

TABLE 5.4-1
Surficial Upper PRM Aquifer Metals
Range of Concentrations

Metals Constituent	Sample Depths	Maximum Concentration (µg/L)/Sampling Location
Aluminum	7.9'-17.9'	33,000/MW-20S (Jackson St.)
Antimony	6.6'-16.6'	23.7/MW-13S (M.A.)
Arsenic	4'-14'	7130/MW-1S (M.A.)
Barium	6.6'-16.6'	36,500/MW-13S (M.A.)
Cadmium	8'-18'	45.7/MW-10S (6 th St.)
Iron	7.9'-17.9'	51,900/MW-20S (6 th St.)
Lead	6.8'-16.8'	192/MW-15S (M.A.)
Manganese	7.8'-17.8'	1350/MW-18S (Everett St.)
Sodium	6.6'-16.6'	184,000/MW013S (M.A.)

M.A. – Martin Aaron Property

As shown on Figure 5-47, metals concentrations above screening levels were equally distributed across the Site including Martin Aaron, Everett Street, Sixth Street, and SJPC. The only properties without metals detections in the surficial aquifer above screening levels included Comarco Products and the Ponte property. However, the highest metals concentrations were detected on Martin Aaron, at MW-18S (upgradient), and Sixth Street (downgradient). The metals results indicate that sources of metals contamination may be present off of the Martin Aaron property on Everett Street and Sixth Street. The most commonly detected metals were arsenic, iron, manganese and sodium. Iron, manganese, sodium, and sometimes arsenic, can occur naturally in the PRM system Aquifers (Langmuir, 1969).

5.4.1.4 Pesticides/PCBs

As shown on Table 5-12 and Figure 5-48, dieldrin was detected, during the June 2002 sampling event, above the screening level in three of the eighteen shallow groundwater sampling locations in the southern portion of the Martin Aaron property. No PCBs were detected above screening levels during the June 2002 sampling event. There was no detection of pesticides, above screening levels, at the other properties. The highest concentration of dieldrin was 0.99 µg/L at MW-12S. There were no detections of pesticides or PCBs, above screening levels, during the September sampling event.

5.4.2 Intermediate Upper PRM (Middle) Aquifer

Ten groundwater samples were collected from the Intermediate Upper PRM Aquifer at the Site from monitoring wells MW-1M, MW-9D, MW-11M, MW-12M, MW-13M, MW-15M, MW-17M, MW-18M, MW-19M, and MW-20M.

5.4.2.1 VOCs

As shown on Table 5-9, VOCs were detected at seven of the ten groundwater sampling locations within the Intermediate PRM Aquifer in June and September 2002. As shown on Figure 5-49, wells with VOCs above screening levels include MW-1M, MW-12M, MW-13M, MW-15M at Martin Aaron, MW-17M upgradient of Martin Aaron, and MW-9D, MW-20M, MW-11M on Sixth Street. Similar to the VOCs in the shallow aquifer, all but one of the Middle Upper PRM Aquifer groundwater samples, with analytical results greater than screening levels, were on or downgradient from Martin Aaron. The exception is upgradient well location MW-17M. Four chlorinated VOCs above screening levels were detected in monitoring wells near the former outdoor drum recycling operations areas in the southwest corner of Martin Aaron. The VOCs detected above screening levels include PCE, cis-1,2-DCE, vinyl chloride, and 1,2-dichloropropane. Benzene was the only VOC identified at MW-17S northwest (upgradient) of Martin Aaron at a concentration of 8.3 µg/L in September 2002. Figure 5-49 presents the September 2002 data for VOCs above screening criteria in the Intermediate Upper PRM Aquifer.

As shown on Table 5-9, the maximum PCE concentration detected in the Intermediate Upper PRM Aquifer was 1 µg/L. The maximum cis-1,2-DCE concentration was 40 µg/L (June 2002) and 37 µg/L (September 2002) detected at MW-15M in the western portion of Martin Aaron. The maximum vinyl chloride concentration was 17 µg/L at MW-15M in September 2002. The highest 1,2-dichloropropane concentration was 1.7 µg/L (September 2002) at MW-11M located on Jackson Street.

5.4.2.2 SVOCs

SVOCs were not detected above screening levels in any groundwater sample collected from the Intermediate Upper PRM Aquifer.

5.4.2.3 Metals

Groundwater samples were analyzed for total and dissolved TAL metals. As shown on Tables 5-11, for June and September 2002 sampling events, metals were detected in all ten of the Intermediate Upper PRM Aquifer sampling locations. All ten samples had at least two detections greater than screening levels. However, more metals compounds were identified

in September 2002 than in June 2002. In June 2002, aluminum, arsenic, iron, and manganese were detected above screening levels. As shown on Figure 5-50, in September 2002 the metals above screening levels are aluminum (total only), antimony (total only), arsenic (dissolved and total), beryllium (total only), iron (dissolved and total), manganese (dissolved and total), sodium (dissolved and total), and thallium (dissolved and total). In September 2002, the maximum metal concentrations and the associated monitoring well are aluminum (14,800 µg/L – MW-15M), antimony (7 µg/L – MW-15M), arsenic (143 µg/L – MW-13M), beryllium (12.8 µg/L – MW-15M), manganese (2,020 µg/L – MW-15M), sodium (70,500 µg/L – MW-13M), and thallium (12.8 µg/L – MW-15M). As shown on Figure 5-50, MW-15M is located near the former source areas on the Martin Aaron property.

5.4.2.4 Pesticides/PCBs

Pesticides and PCBs were not detected above screening levels in any groundwater sample collected from the Intermediate Upper PRM Aquifer.

5.4.3 Basal Upper PRM (Regional) Aquifer

Three groundwater samples were collected from the Basal Upper PRM Aquifer within and downgradient from the Martin Aaron property to the northeast and southeast. As shown on Figure 5-51, TCE and vinyl chloride were detected above screening levels at the Martin Aaron property and Sixth Street monitoring well locations.

5.4.3.1 VOCs

As shown on Table 5-9, in June 2002, VOCs were detected at one well (MW-20R) including: cis-1,2-DCE, TCE, and vinyl chloride. As shown on Table 5-9 and Figure 5-51, in September 2002, all three regional wells (MW-14R, MW-19R, MW-20R) showed elevated levels of vinyl chloride, and one slightly elevated TCE concentration at MW-20R.

5.4.3.2 SVOCs

SVOCs were not detected in any of the samples collected from the Basal Upper PRM Aquifer.

5.4.3.3 Metals

As shown in Table 5-11, metals were detected in all three of the regional groundwater sampling locations, and all three samples had multiple detections greater than screening levels. As shown on Figure 5-52, the metals above screening levels are aluminum (dissolved and total), beryllium (dissolved only), iron (dissolved and total), manganese (dissolved and total), sodium (dissolved and total), and thallium (dissolved and total). In September 2002, the maximum concentration for the metals compounds and their associated monitoring well locations are aluminum (1,080 µg/L - MW-20R), beryllium (5µg/L - MW-20R), iron (133,000 µg/L – MW-20R), manganese (4,540 µg/L – MW-19R), sodium (3,060,000 µg/L – MW-19R), and thallium (12.9 µg/L – MW-19R).

As shown on Figure 5-52, MW-19R is located on Sixth Street, upgradient of Martin Aaron, and MW-20R is located on Sixth Street downgradient of Martin Aaron. The metals present appear to be naturally occurring and are not suspected to be associated with contamination from the Martin Aaron property.

5.4.3.4 Pesticides/PCBs

Pesticides and PCBs were not detected in any of the samples collected from the Basal Upper PRM Aquifer.

5.4.4 Upper Middle PRM (Deep) Aquifer

Two groundwater samples were collected from the Upper Middle PRM Aquifer within the Site, upgradient of Martin Aaron to the north and on Martin Aaron. These samples were taken from monitoring wells MW-18D and MW-14D as shown on Figure 5-53.

5.4.4.1 VOCs

VOCs were not detected in any one of the two groundwater sampling locations in the Middle PRM Aquifer.

5.4.4.2 SVOCs

SVOCs were not detected in any of the samples collected from the Upper Middle PRM Aquifer.

5.4.4.3 Metals

As shown on Figure 5-53, metals were detected at three deep groundwater sampling locations. The metals detected above screening levels are aluminum (total only), beryllium (dissolved only), iron (dissolved and total), lead (total only), manganese (dissolved and total), sodium (dissolved and total), and thallium (dissolved and total). As described above, these metals are known to occur naturally in the PRM Aquifer system.

5.4.4.4 Pesticides/PCBs

Pesticides and PCBs were not detected in any of the samples collected from the Upper Middle PRM Aquifer.

5.4.5 City of Camden Well 7

Groundwater samples were collected from the City of Camden's Well No. 7 in both July and September 2002 for the VOC, SVOCs, metals, pesticides/PCBs. As shown on Table 5-13, there were only two compounds detected above screening levels (iron, manganese). There were no detections of SVOCs, pesticides, or PCBs above screening levels in water samples collected from Well 7.

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Table 5-1
Surface Soil -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-02	MA-SB-08	MA-SB-130	MA-SB-31	MA-SB-47
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB02-SS	MA-SB08-SS	MA-SB130-SS	MA-SB31-SS	MA-SB47-SS
Sample Date				10/18/2001	10/16/2001	10/17/2001	10/17/2001	10/18/2001
Sample Interval				0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				B0DD7	B0DA9	B0DC0	B0DC5	B0DD1
Chemical Name								
Volatile Organic Compounds (ug/Kg)								
Benzene	1000	13000	30		100 J (C)	10 J		
Chlorobenzene	1000		1000					
Chloroform	1000	28000	600			6 J		
Dichloroethane-1,1	10000		23000	25	18 J		11000 J (A)	
Dichloroethylene-1,2 cis	1000	1000000	400	180	19 J		24000 (AC)	530 J (C)
Methylene chloride	1000		20			7 J (C)		
Tetrachloroethylene	1000	6000	60	21	13 J	62 (C)	26000 (ABC)	11000 (ABC)
Toluene	500000	1000000	12000		52 J	22	160000 (C)	
Trichlorobenzene-1,2,4	100000		5000					
Trichloroethane-1,1,1	50000		2000	11		43		
Trichloroethylene	1000	54000	60	5 J	7 J	17	60000 (ABC)	2300 (AC)
Vinyl chloride	10000	7000	10	35 (C)	9 J			

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-1
Surface Soil -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-56	MA-SB-60	MA-SB-81	MA-SB-81	MA-SO-201
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB56-SS	MA-SB60-SS	MA-SB81-SS	MA-SB81-SS-D	MA-SO201-SS
Sample Date				10/16/2001	10/16/2001	10/18/2001	10/18/2001	10/17/2001
Sample Interval				0.5 - 1 ft	1.5 - 2 ft	0.5 - 1 ft	0.5 - 1 ft	1.5 - 2 ft
CLP Sample ID				B0DA3	B0DA4	B0DE1	B0DD9	B0DB8
Chemical Name								
Volatile Organic Compounds (ug/Kg)								
Benzene	1000	13000	30	4 J	260 J (C)			4500 (AC)
Chlorobenzene	1000		1000		3200 (AC)			
Chloroform	1000	28000	600					1400 (AC)
Dichloroethane-1,1	10000		23000		4700			810 J
Dichloroethylene-1,2 cis	1000	1000000	400		3200 (AC)			740 J (C)
Methylene chloride	1000		20					
Tetrachloroethylene	1000	6000	60	64 J (C)	1200 (AC)	64 (C)	84 (C)	3700 (AC)
Toluene	500000	1000000	12000	13 J	7600			5600
Trichlorobenzene-1,2,4	100000		5000					5900 (C)
Trichloroethane-1,1,1	50000		2000		2000 (C)			
Trichloroethylene	1000	54000	60	60 (C)	710 J (C)		4 J	7900 (AC)
Vinyl chloride	10000	7000	10		320 J (C)			

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-02	MA-SB-06	MA-SB-08	MA-SB-09	MA-SB-108
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB02-SS	MA-SB06-SS	MA-SB08-SS	MA-SB09-SS	MA-SB108-SS
Sample Date				10/18/2001	10/15/2001	10/16/2001	10/15/2001	10/22/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				B0DD7	B0D96	B0DA9	B0D91	B0DF9
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	120000 J (BC)	21000 (BC)	1900 J	1000	1500
Benzo(a)pyrene	100000	660	8000	110000 J (ABC)	20000 (BC)	2400 J (B)	1200 (B)	1200 (B)
Benzo(b)fluoranthene	50000	4000	5000	110000 J (ABC)	24000 (BC)	3000 J	1500	1600
Benzo(k)fluoranthene	500000	4000	49000	71000 J (BC)	12000 (B)	1900 J	880	1100
Carbazole			600	12000 J (C)	2400 J (C)	140 J	170 J	98 J
Chrysene	500000	40000	160000	120000 J (B)	20000	1900 J	1000	1300
Dibenzo(a,h)anthracene	100000	660	2000	19000 J (BC)	5400 J (BC)	710 J (B)	210 J	290 J
Fluoranthene	100000	10000000	4300000	290000 J (A)	48000	3400 J	2200	2100
Indeno(1,2,3-cd)pyrene	500000	4000	14000	59000 J (BC)	12000 (B)	2000 J	800	900 J
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	230000 J (A)	37000	2600 J	2000	2700

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

05/20/2004

Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-108	MA-SB-11	MA-SB-112	MA-SB-118	MA-SB-120
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB108-SS-D	MA-SB11-SS	MA-SB112-SS	MA-SB118-SS	MA-SB120-SS
Sample Date				10/22/2001	10/15/2001	10/17/2001	10/18/2001	10/16/2001
Sample Interval				0.5 - 1 ft	1.5 - 2 ft	0.5 - 1 ft	0.5 - 1 ft	1 - 2.5 ft
CLP Sample ID				B0DG1	B0D99	B0DC4	B0DD8	B0DB0
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	2100 (C)	5100 (BC)	20000 (BC)	13000 (BC)	600 J
Benzo(a)pyrene	100000	660	8000	1900 (B)	5600 (B)	17000 (BC)	13000 (BC)	670 J (B)
Benzo(b)fluoranthene	50000	4000	5000	2400	6900 (BC)	22000 (BC)	19000 (BC)	830 J
Benzo(k)fluoranthene	500000	4000	49000	1400	3800	9200 (B)	7900 (B)	410 J
Carbazole			600	84 J	560 J	2500 J (C)	2400 J (C)	
Chrysene	500000	40000	160000	1900	4800	20000	14000	660 J
Dibenzo(a,h)anthracene	100000	660	2000	470 J	860 J (B)	3500 J (BC)	2200 J (BC)	130 J
Fluoranthene	100000	10000000	4300000	2400	11000	33000	32000	880 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	1500 J	4200 (B)	9800 (B)	9000 (B)	490 J
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	4200	7800	29000	24000	880 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

05/20/2004

Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-124	MA-SB-124	MA-SB-13	MA-SB-130	MA-SB-31
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB124-SS	MA-SB124-SS-D	MA-SB13-SS	MA-SB130-SS	MA-SB31-SS
Sample Date				10/17/2001	10/17/2001	10/19/2001	10/17/2001	10/17/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft
CLP Sample ID				B0DB7	B0DB4	B0DF5	B0DC0	B0DC5
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	7600 (BC)	19000 (BC)	1800	3700 (C)	1400 J
Benzo(a)pyrene	100000	660	8000	8000 (BC)	20000 (BC)	1600 (B)	3200 (B)	1200 J (B)
Benzo(b)fluoranthene	50000	4000	5000	10000 (BC)	25000 (BC)	2600	4000 (B)	1500 J
Benzo(k)fluoranthene	500000	4000	49000	4100 (B)	11000 (B)	800	1900	1300 J
Carbazole			600	1500 J (C)	2600 J (C)	350	790 (C)	630 J (C)
Chrysene	500000	40000	160000	9700	20000	1700	3500	2300 J
Dibenzo(a,h)anthracene	100000	660	2000	2300 J (BC)	3300 J (BC)	280 J	570	150 J
Fluoranthene	100000	10000000	4300000	15000	35000	4300	6800	3700 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	5700 (B)	12000 (B)	1000	2200	820 J
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					1100 J (C)
Pyrene	100000	10000000	4200000	13000	38000	3300	5500	3500 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

05/20/2004

Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-56	MA-SB-56	MA-SB-60	MA-SB-62	MA-SB-67
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB56-SS	MA-SB56-SS-D	MA-SB60-SS	MA-SB62-SS-1	MA-SB67-SS-1.0
Sample Date				10/16/2001	10/16/2001	10/16/2001	12/12/2001	12/12/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1.5 - 2 ft	1 - 1.5 ft	1 - 1.5 ft
CLP Sample ID				B0DA3	B0DA0	B0DA4	B0DX1	B0DX4
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	11000 (BC)	1400	4500 J (BC)	910 J	2200 J (C)
Benzo(a)pyrene	100000	660	8000	9400 (BC)	1100 (B)	5700 J (B)	780 J (B)	1700 J (B)
Benzo(b)fluoranthene	50000	4000	5000	11000 (BC)	1600	7700 J (BC)	720 J	1500 J
Benzo(k)fluoranthene	500000	4000	49000	5400 (B)		4100 J (B)	820 J	1800 J
Carbazole			600	1500 J (C)	93 J	760 J (C)		
Chrysene	500000	40000	160000	13000	1600	6700 J	1100 J	2100 J
Dibenzo(a,h)anthracene	100000	660	2000	2500 J (BC)	270 J	1700 J (B)		
Fluoranthene	100000	10000000	4300000	18000	2100	8800 J	1700 J	3600 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	5200 (B)	570	4300 J (B)	430 J	770 J
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	17000	2200	7200 J	1900 J	3100 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

05/20/2004

Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-68	MA-SB-72	MA-SB-75	MA-SB-82	MA-SB-85
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB68-SS-1.0	MA-SB72-SS-0.5	MA-SB75-SS-1.0	MA-SB82-SS	MA-SB85-SS-1.0
Sample Date				12/13/2001	12/13/2001	12/12/2001	10/19/2001	12/17/2001
Sample Interval				1 - 1.5 ft	0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft	1 - 1.5 ft
CLP Sample ID				B0DY7	B0DY9	B0DW6	B0DE8	B0FW1
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	1500 J	5200 J (B)	1800 J	3400 (C)	21000 (BC)
Benzo(a)pyrene	100000	660	8000	1500 J (B)	4400 J (B)	1800 J (B)	3300 (B)	17000 (BC)
Benzo(b)fluoranthene	50000	4000	5000	1500 J	4400 J (B)	1800 J	4400 (B)	15000 (BC)
Benzo(k)fluoranthene	500000	4000	49000	1100 J	4400 J (B)	1600 J	1700 J	19000 (B)
Carbazole			600		590 J		550 J	4100 J (C)
Chrysene	500000	40000	160000	1600 J	5200 J	2200 J	3400	21000
Dibenzo(a,h)anthracene	100000	660	2000		550 J	380 J	560 J	2400 J (BC)
Fluoranthene	100000	10000000	4300000	2700 J	13000 J	3600 J	7000	40000
Indeno(1,2,3-cd)pyrene	500000	4000	14000	800 J	1700 J	1100 J	2200	6400 J (B)
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	2600 J	8800 J	3300 J	6800	30000

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

05/20/2004

Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-201	MA-SO-202	MA-SO-203	MA-SO-207	MA-SO-208
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO201-SS	MA-SO202-SS-1	MA-SO203-SS	MA-SO207-SS	MA-SO208-SS
Sample Date				10/17/2001	12/14/2001	10/19/2001	10/22/2001	10/22/2001
Sample Interval				1.5 - 2 ft	1 - 1.5 ft	0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				B0DB8	B0FT0	B0DF4	B0DH3	B0DH6
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	1000	3700 J (C)	900	1500	1900
Benzo(a)pyrene	100000	660	8000	860 (B)	3100 J (B)	990 (B)	1100 (B)	1300 (B)
Benzo(b)fluoranthene	50000	4000	5000	1200	2300 J	1700	1100	2000
Benzo(k)fluoranthene	500000	4000	49000	710	3800 J	570	990	1000
Carbazole			600		750 J (C)	21 J	130 J	260 J
Chrysene	500000	40000	160000	1100	4100 J	1100	1500	1700
Dibenzo(a,h)anthracene	100000	660	2000	290 J		190 J	200 J	290 J
Fluoranthene	100000	10000000	4300000	1400	8700 J	1200	2500	3100
Indeno(1,2,3-cd)pyrene	500000	4000	14000	650	1100 J	640	610 J	860 J
Nitrosodiphenylamine-n	100000		1000	1300 (C)				
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	1900	5200 J	1500	2900	3900

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

05/20/2004

Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-210	MA-SO-212	MA-SO-212	MA-SO-213	MA-SO-214
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO210-SS-0.5	MA-SO212-SS-1.0	MA-SO212-SS-1.0D	MA-SO213-SS-1.0	MA-SO214-SS
Sample Date				12/14/2001	12/14/2001	12/14/2001	12/14/2001	10/18/2001
Sample Interval				0.5 - 1 ft	1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				B0FW3	B0FT4	B0FT7	B0FT5	B0DD2
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	1800 J	970 J	1600 J	1200 J	6900 (BC)
Benzo(a)pyrene	100000	660	8000	1600 J (B)	900 J (B)	1500 J (B)	870 J (B)	7300 (B)
Benzo(b)fluoranthene	50000	4000	5000	1900 J	980 J	1500 J	870 J	10000 (BC)
Benzo(k)fluoranthene	500000	4000	49000	1300 J	990 J	1600 J	990 J	4200 (B)
Carbazole			600	450 J				810 J (C)
Chrysene	500000	40000	160000	1900 J	1100 J	1700 J	1200 J	7400
Dibenzo(a,h)anthracene	100000	660	2000	360 J				1400 J (B)
Fluoranthene	100000	10000000	4300000	3800 J	1900 J	3000 J	2000 J	11000
Indeno(1,2,3-cd)pyrene	500000	4000	14000	1000 J	320 J	440 J	260 J	4100 (B)
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	3100 J	1700 J	2700 J	1900 J	11000

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-301	MA-SO-301	MA-SO-303	MA-SO-401	MA-SO-401
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO301-SS-1.0	MA-SO301-SS-1.0D	MA-SO303-SS-1.0	MA-SO401-SS-1.0	MA-SO401-SS-1.0D
Sample Date				12/13/2001	12/13/2001	12/13/2001	12/17/2001	12/17/2001
Sample Interval				1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft
CLP Sample ID				B0DY2	B0DY3	B0DY0	B0FX7	B0FW8
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	50000 J (BC)	130000 J (BC)	6100 J (BC)	5900 J (BC)	8700 J (BC)
Benzo(a)pyrene	100000	660	8000	39000 J (BC)	97000 J (BC)	5200 J (B)	4700 J (B)	7400 J (B)
Benzo(b)fluoranthene	50000	4000	5000	37000 J (BC)	97000 J (ABC)	5500 J (BC)	3700 J	6400 J (BC)
Benzo(k)fluoranthene	500000	4000	49000	45000 J (B)	110000 J (BC)	3800 J	5500 J (B)	9200 J (B)
Carbazole			600	14000 J (C)	43000 J (C)	1000 J (C)	1200 J (C)	1600 J (C)
Chrysene	500000	40000	160000	51000 J (B)	130000 J (B)	6300 J	6000 J	8900 J
Dibenzo(a,h)anthracene	100000	660	2000			800 J (B)		
Fluoranthene	100000	10000000	4300000	120000 J (A)	330000 J (A)	11000 J	10000 J	15000 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	15000 J (BC)	40000 J (BC)	2100 J		
Nitrosodiphenylamine-n	100000		1000					
PCP (Pentachlorophenol)	100000		30					
Pyrene	100000	10000000	4200000	82000 J	220000 J (A)	10000 J	9100 J	13000 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-2
Surface Soil -Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-402	MA-SO-403	MA-SO-404
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO402-SS-1.0	MA-SO403-SS-1.0	MA-SO404-SS-1.0
Sample Date				12/17/2001	12/17/2001	12/17/2001
Sample Interval				1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft
CLP Sample ID				B0FX6	B0FX2	B0FX5
Chemical Name						
Semivolatile Organic Compounds (ug/Kg)						
Benzo(a)anthracene	500000	4000	2000	6600 J (BC)	8200 (BC)	24000 (BC)
Benzo(a)pyrene	100000	660	8000	5100 J (B)	6300 J (B)	18000 (BC)
Benzo(b)fluoranthene	50000	4000	5000	3800 J	4700 J (B)	16000 (BC)
Benzo(k)fluoranthene	500000	4000	49000	5500 J (B)	8200 J (B)	18000 (B)
Carbazole			600		720 J (C)	7200 J (C)
Chrysene	500000	40000	160000	7000 J	7800	23000
Dibenzo(a,h)anthracene	100000	660	2000		670 J (B)	2000 J (BC)
Fluoranthene	100000	10000000	4300000	13000 J	17000	57000
Indeno(1,2,3-cd)pyrene	500000	4000	14000	2900 J	1700 J	5700 J (B)
Nitrosodiphenylamine-n	100000		1000			
PCP (Pentachlorophenol)	100000		30			
Pyrene	100000	10000000	4200000	11000 J	8600	48000

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-02	MA-SB-04	MA-SB-06	MA-SB-08	MA-SB-09
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB02-SS	MA-SB04-SS	MA-SB06-SS	MA-SB08-SS	MA-SB09-SS
Sample Date				10/18/2001	10/16/2001	10/15/2001	10/16/2001	10/15/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				MB0CJ5	MB0CG1	MB0CF2	MB0CF9	MB0CE7
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5			2.8 BJ	2.9 BJ	
Arsenic		20	29	25.3 (B)	39.8 (BC)	90.2 (BC)	457 (BC)	11.3
Barium		47000	1600	475	111	717	2440 (C)	4320 (C)
Cadmium		100	8	0.51 B	0.38 B	4.8	3.2	1.1
Chromium		20	38	28.3 (B)	18.3	93.2 (BC)	107 (BC)	13
Copper		600		38.1	6.3	107	65	18.6
Lead		600		139	8.5	521	410	121
Nickel		2400	130	12.7	3.2 B	22.8	29.8	5.9 B
Selenium			5			1.6		
Silver		4100	34			1.8 B	0.36 B	1 B
Thallium		2						
Zinc		1500	12000	110	98.8 J	328 J	331 J	153 J

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-106	MA-SB-108	MA-SB-108	MA-SB-11	MA-SB-118
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB106-SS	MA-SB108-SS	MA-SB108-SS-D	MA-SB11-SS	MA-SB118-SS
Sample Date				10/22/2001	10/22/2001	10/22/2001	10/15/2001	10/18/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	1.5 - 2 ft	0.5 - 1 ft
CLP Sample ID				MB0CL9	MB0CL2	MB0CL4	MB0CF3	MB0CJ6
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	0.98 B	3.3 B	1.9 B	1.8 BJ	1.7 BJ
Arsenic		20	29	23.6 (B)	17.5	19.6	9.5	32.8 J (BC)
Barium		47000	1600	16500 J (C)	20100 J (C)	15400 J (C)	224	3230 (C)
Cadmium		100	8	0.98 B	4.5	3.7	1.4	1.8
Chromium		20	38	21.4 (B)	22.8 (B)	17.3	26.3 (B)	61.4 (BC)
Copper		600		50.8	115	52.9	281	160
Lead		600		508	3190 (B)	1110 (B)	286	612 (B)
Nickel		2400	130	12.8	19.9	15.5	13.1	17.6
Selenium			5	3.8 J	1.6 J	1.3 J		1.8
Silver		4100	34				0.7 B	0.5 B
Thallium		2		1.6 B		1.7 B		
Zinc		1500	12000	976	1290	1260	238 J	522

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-120	MA-SB-122	MA-SB-124	MA-SB-124	MA-SB-130
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB120-SS	MA-SB122-SS	MA-SB124-SS	MA-SB124-SS-D	MA-SB130-SS
Sample Date				10/16/2001	10/16/2001	10/17/2001	10/17/2001	10/17/2001
Sample Interval				1 - 2.5 ft	0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				MB0CG3	MB0CG5	MB0CH0	MB0CG7	MB0CH2
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	1.2 BJ	2.1 BJ	1.7 BJ	1.8 BJ	7.1 BJ (C)
Arsenic		20	29	11.9	217 (BC)	301 (BC)	253 (BC)	179 (BC)
Barium		47000	1600	414	2280 (C)	5600 (C)	3140 (C)	4010 (C)
Cadmium		100	8	1 B	1.2	4.1	3.8	7.4
Chromium		20	38	23.2 (B)	205 (BC)	1080 (BC)	1080 (BC)	422 (BC)
Copper		600		50.1	61.3	446	282	1400 (B)
Lead		600		155	241	1450 (B)	607 (B)	1480 (B)
Nickel		2400	130	10.4	15.1	43.9	28.1	87.2
Selenium			5		1.4	1.4		2.4
Silver		4100	34		0.95 B	1.3 B	0.43 B	0.72 B
Thallium		2						
Zinc		1500	12000	213 J	421 J	773	714	2270 (B)

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-14	MA-SB-29	MA-SB-31	MA-SB-42	MA-SB-47
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB14-SS	MA-SB29-SS-1.0	MA-SB31-SS	MA-SB42-SS	MA-SB47-SS
Sample Date				10/15/2001	12/12/2001	10/17/2001	10/18/2001	10/18/2001
Sample Interval				1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				MB0CE9	MB0CZ6	MB0CH6	MB0CJ0	MB0CJ1
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	2.3 BJ		7.6 BJ (C)		1.9 BJ
Arsenic		20	29	36.3 (BC)	46.4 (BC)	8.3	11.7 (BC)	64.1 (BC)
Barium		47000	1600	5470 (C)	1580 J	1230	18.5 B	189
Cadmium		100	8	3.3	1.1	110 (BC)		31.8 (C)
Chromium		20	38	73.3 (BC)	18.5 J	272 (BC)	16.1	79 (BC)
Copper		600		92.3	105	646 (B)	4 B	78.6
Lead		600		380	390	853 (B)	8.3	511
Nickel		2400	130	21.6		576 (C)	1.5 B	35.5
Selenium			5	1.1	1 B	4.3		1.1 B
Silver		4100	34	12.9	2 J	45.7 (C)		0.9 B
Thallium		2						
Zinc		1500	12000	553 J		1460	9.9	632

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-56	MA-SB-56	MA-SB-60	MA-SB-62	MA-SB-66
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB56-SS	MA-SB56-SS-D	MA-SB60-SS	MA-SB62-SS-1	MA-SB66-SS-0.5
Sample Date				10/16/2001	10/16/2001	10/16/2001	12/12/2001	12/13/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1.5 - 2 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				MB0CF7	MB0CF4	MB0CG0	MB0CZ1	MB0D15
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	5.9 BJ (C)	1.1 BJ	3.3 BJ	0.88 J	0.81 BJ
Arsenic		20	29	74.8 (BC)	53.8 (BC)	766 (BC)	13.1	21.7 J (B)
Barium		47000	1600	15100 (C)	33400 (C)	1260	646 J	3050 (C)
Cadmium		100	8	1.3	1.1 B	4.1	1 B	1.9
Chromium		20	38	197 (BC)	87.9 (BC)	65.4 (BC)	24 J (B)	75 (BC)
Copper		600		598	453	106	63.4	39.1
Lead		600		502	140	450	97.9 (B)	356
Nickel		2400	130	11	12.8	21.4		10
Selenium			5	2.6	1.7	1.1 B	1.1	
Silver		4100	34	0.35 B	0.33 B	0.37 B	0.38 J	
Thallium		2						
Zinc		1500	12000	380 J	504 J	974 J		339

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-71	MA-SB-72	MA-SB-75	MA-SB-77	MA-SB-78
Sample ID	IGWSCC	NRDCSCC	EPASSLDA	MA-SB71-SS-0.5	MA-SB72-SS-0.5	MA-SB75-SS-1.0	MA-SB77-SS-1.0	MA-SB78-SS-0.5
Sample Date			F20	12/13/2001	12/13/2001	12/12/2001	12/12/2001	12/13/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				MB0D16	MB0D13	MB0981	MB0D00	MB0D09
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5		2.6 BJ	1.9 J	0.99 J	1.1 BJ
Arsenic		20	29	6.3 J	15 J	33.1 (BC)	20.3 (B)	8.7 J
Barium		47000	1600	4410 (C)	567	2460 J (C)	333 J	5070 (C)
Cadmium		100	8	0.32 B	1 B	4.4	0.5 B	2.2
Chromium		20	38	8.5	20.1 (B)	189 J (BC)	24.9 (B)	23.7 (B)
Copper		600		18.7	80.5	90.6	68.1	92.5
Lead		600		61.4	758 (B)	872 (B)	236	588
Nickel		2400	130	5.1 B	9.6 B			10.6
Selenium			5	1.2		1.4		
Silver		4100	34			0.41 J		
Thallium		2						
Zinc		1500	12000	84.4	473			550

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-81	MA-SB-81	MA-SB-82	MA-SB-85	MA-SB-96
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB81-SS	MA-SB81-SS-D	MA-SB82-SS	MA-SB85-SS-1.0	MA-SB96-SS
Sample Date				10/18/2001	10/18/2001	10/19/2001	12/17/2001	10/22/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				MB0CJ9	MB0CJ7	MB0CK5	MB0ES7	MB0CL7
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5				3.5 BJ	2.7 B
Arsenic		20	29	24.2 J (B)	24.6 J (B)	18.8 J	24 (B)	63 (BC)
Barium		47000	1600	30800 (C)	37900 (C)	2030 (C)	241	13200 J (C)
Cadmium		100	8	41.8 (C)	24.4 (C)	2.1	1.5 J	2.9
Chromium		20	38	24.4 (B)	22.2 (B)	30.1 (B)	25.5 (B)	113 (BC)
Copper		600		74.9	75.8	56	134	86.3
Lead		600		541	707 (B)	377	559	952 (B)
Nickel		2400	130	14.5	14.9	16.4	18.5	16.4
Selenium			5	1.5	1.5	1.6	1.5	1.5 J
Silver		4100	34				0.24 B	0.89 BJ
Thallium		2						
Zinc		1500	12000	6640 (B)	5530 (B)	553	347	721

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-97	MA-SB-98	MA-SO-201	MA-SO-202	MA-SO-203
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB97-SS	MA-SB98-SS	MA-SO201-SS	MA-SO202-SS-1	MA-SO203-SS
Sample Date				10/22/2001	10/22/2001	10/17/2001	12/14/2001	10/19/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1.5 - 2 ft	1 - 1.5 ft	0.5 - 1 ft
CLP Sample ID				MB0CL5	MB0CM3	MB0CH1	MB0D18	MB0CK9
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	3.2 B	1.6 B	3.5 BJ	3.4 BJ	1.8 BJ
Arsenic		20	29	18.7	66.8 (BC)	83 (BC)	7.4	30.6 J (BC)
Barium		47000	1600	18200 J (C)	5030 J (C)	16600 (C)	888	6980 (C)
Cadmium		100	8	4.7	0.8 B	5.2	2.2 J	1 B
Chromium		20	38	23.9 (B)	9.8	444 (BC)	413 (BC)	81.4 (BC)
Copper		600		162	43.7	607 (B)	159	410
Lead		600		3310 (B)	419	515	552	1140 (B)
Nickel		2400	130	20.4	10.6	102	7.2 B	30
Selenium			5	1.2 J	1.5 J	1.8	1	1.6
Silver		4100	34				1.7 B	
Thallium		2						
Zinc		1500	12000	1320	324	859	492	252

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-207	MA-SO-208	MA-SO-209	MA-SO-210	MA-SO-211
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO207-SS	MA-SO208-SS	MA-SO209-SS	MA-SO210-SS-0.5	MA-SO211-SS-1.0
Sample Date				10/22/2001	10/22/2001	10/22/2001	12/14/2001	12/14/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft
CLP Sample ID				MB0CM4	MB0CM6	MB0CM8	MB0ER4	MB0ES1
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	1.1 B	37.2 (C)	7.6 B (C)		1.5 BJ
Arsenic		20	29	365 (BC)	103 (BC)	19.5	5.1 J	17.8 J
Barium		47000	1600	9020 J (C)	5680 J (C)	19100 J (C)	6680 (C)	16000 (C)
Cadmium		100	8	0.27 B	37 (C)	36.6 (C)	1.7	4.8
Chromium		20	38	160 (BC)	16.2	14.5	18.3	14.5
Copper		600		13.5	269	144	21.8	49.9
Lead		600		124	10600 (B)	112000 (B)	198	989 (B)
Nickel		2400	130	6.5 B	26.2	9.5	7.8 B	8.8 B
Selenium			5	0.99 BJ	5.9 J (C)	2.7 J		1.6
Silver		4100	34		2 BJ			
Thallium		2			3.9 (B)	6.4 (B)		
Zinc		1500	12000	426	23900 (BC)	1880 (B)	573	1200

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-212	MA-SO-212	MA-SO-213	MA-SO-214	MA-SO-301
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO212-SS-1.0	MA-SO212-SS-1.0D	MA-SO213-SS-1.0	MA-SO214-SS	MA-SO301-SS-1.0
Sample Date				12/14/2001	12/14/2001	12/14/2001	10/18/2001	12/13/2001
Sample Interval				1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	0.5 - 1 ft	1 - 1.5 ft
CLP Sample ID				MB0ER7	MB0ER9	MB0ES0	MB0CJ2	MB0D04
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	4.1 BJ	3.2 BJ		2.8 BJ	1.2 J
Arsenic		20	29	27.7 J (B)	21 J (B)	7.7 J	14.9	17.5
Barium		47000	1600	13000 (C)	13800 (C)	12100 (C)	3660 (C)	3290 J (C)
Cadmium		100	8	17.8 (C)	18.3 (C)	0.62 B	2	0.75 B
Chromium		20	38	16.2	15.1	9.6	53.8 (BC)	31 J (B)
Copper		600		99.7	90.7	21	64.2	93.7
Lead		600		2140 (B)	1620 (B)	278	497	502
Nickel		2400	130	9.7	10.8	6.5 B	15.4	
Selenium			5	1.3	1.2		1.2	2
Silver		4100	34	0.53 B	0.49 B			
Thallium		2						
Zinc		1500	12000	1880 (B)	1650 (B)	446	453	

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-301	MA-SO-302	MA-SO-303	MA-SO-401	MA-SO-401
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO301-SS-1.0D	MA-SO302-SS-1.0	MA-SO303-SS-1.0	MA-SO401-SS-1.0	MA-SO401-SS-1.0D
Sample Date				12/13/2001	12/12/2001	12/13/2001	12/17/2001	12/17/2001
Sample Interval				1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft
CLP Sample ID				MB0D05	MB0CZ2	MB0D02	MB0ET3	MB0ET4
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	1.9 J	1.4 J	1.9 J	1.9 BJ	1.5 BJ
Arsenic		20	29	23 (B)	17.7	33.8 (BC)	339 (BC)	321 (BC)
Barium		47000	1600	3360 J (C)	1080 J	796	12600 (C)	10900 (C)
Cadmium		100	8	1.1 B	5.1	0.86 B	4.6 J	3.9 J
Chromium		20	38	34.7 J (B)	24.5 J (B)	13 J	256 (BC)	225 (BC)
Copper		600		160	358	67.5	58.7	57.5
Lead		600		1110 (B)	1020 (B)	541	512	661 (B)
Nickel		2400	130				15.5	13.6
Selenium			5	2.5	2.1	1.5	1.6	1.6
Silver		4100	34	0.26 J	0.88 J			
Thallium		2						
Zinc		1500	12000				1740 (B)	1670 (B)

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-3
Surface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-402	MA-SO-403	MA-SO-404
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO402-SS-1.0	MA-SO403-SS-1.0	MA-SO404-SS-1.0
Sample Date				12/17/2001	12/17/2001	12/17/2001
Sample Interval				1 - 1.5 ft	1 - 1.5 ft	1 - 1.5 ft
CLP Sample ID				MB0ET2	MB0ET6	MB0ET5
Chemical Name						
Metals (mg/Kg)						
Antimony		340	5	1.1 BJ	1.2 BJ	1.6 BJ
Arsenic		20	29	322 (BC)	246 (BC)	40.4 (BC)
Barium		47000	1600	7030 (C)	4670 (C)	22600 (C)
Cadmium		100	8	2.3 J	0.91 BJ	1.6 J
Chromium		20	38	261 (BC)	326 (BC)	33.8 (B)
Copper		600		44.5	52.9	33.4
Lead		600		548	526	505
Nickel		2400	130	10.7	12.4	12
Selenium			5	1.2	1.7	1.4
Silver		4100	34		0.23	
Thallium		2				
Zinc		1500	12000	900	507	738

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-4
Surface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-02	MA-SB-06	MA-SB-08	MA-SB-106	MA-SB-108
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB02-SS	MA-SB06-SS	MA-SB08-SS	MA-SB106-SS	MA-SB108-SS
Sample Date				10/18/2001	10/15/2001	10/16/2001	10/22/2001	10/22/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				B0DD7	B0D96	B0DA9	B0DG7	B0DF9
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500			28		
BHC, beta			3					
DDE-4,4	50000	9000	54000	68 J	630	420		11 NJ
Dieldrin	50000	180	4	15 J (C)	73 JN (C)		6.6 J (C)	13 (C)
Pcb-araclor 1254		2000				10000 J (B)		240 J
Pcb-araclor 1260		2000				7200 J (B)		200 NJ

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-4
Surface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-108	MA-SB-118	MA-SB-120	MA-SB-122	MA-SB-124
Sample ID	IGWSCC	NRDCSCC	EPASSLDA	MA-SB108-SS-D	MA-SB118-SS	MA-SB120-SS	MA-SB122-SS	MA-SB124-SS
Sample Date			F20	10/22/2001	10/18/2001	10/16/2001	10/16/2001	10/17/2001
Sample Interval				0.5 - 1 ft	0.5 - 1 ft	1 - 2.5 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				B0DG1	B0DD8	B0DB0	B0DB3	B0DB7
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500					160 J
BHC, beta			3					
DDE-4,4	50000	9000	54000	11 NJ	81 J	15 J	30	260
Dieldrin	50000	180	4	15 J (C)		5.7 JN (C)	15 JN (C)	1300 (BC)
Pcb-araclor 1254		2000		220 J	2000 (B)			
Pcb-araclor 1260		2000		240 NJ				

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-4
 Surface Soil - PCB and Pesticide Results Above Criteria
 Martin Aaron Superfund Site
 Camden, NJ
 Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-124	MA-SB-14	MA-SB-47	MA-SB-60	MA-SB-81
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB124-SS-D	MA-SB14-SS	MA-SB47-SS	MA-SB60-SS	MA-SB81-SS
Sample Date				10/17/2001	10/15/2001	10/18/2001	10/16/2001	10/18/2001
Sample Interval				0.5 - 1 ft	1 - 1.5 ft	0.5 - 1 ft	1.5 - 2 ft	0.5 - 1 ft
CLP Sample ID				B0DB4	B0D93	B0DD1	B0DA4	B0DE1
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500	90	2.6 JN		1300 (BC)	
BHC, beta			3	94 JN (C)			37 (C)	3.8 JN (C)
DDE-4,4	50000	9000	54000	130 J	94	28	850 J	
Dieldrin	50000	180	4	640 (BC)	6.9 JN (C)	13 (C)	230 J (BC)	
Pcb-araclor 1254		2000			370 J		4700 (B)	47
Pcb-araclor 1260		2000				280		

J - Reported value estimated in quantity

N - Quality control sample spike recovery for this analyte was outside specified limits

(A, B, C) - Exceeds criteria

Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria

NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria

EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-4
Surface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-81	MA-SO-201	MA-SO-203	MA-SO-204	MA-SO-208
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB81-SS-D	MA-SO201-SS	MA-SO203-SS	MA-SO204-SS-0.5	MA-SO208-SS
Sample Date				10/18/2001	10/17/2001	10/19/2001	12/17/2001	10/22/2001
Sample Interval				0.5 - 1 ft	1.5 - 2 ft	0.5 - 1 ft	0.5 - 1 ft	0.5 - 1 ft
CLP Sample ID				B0DD9	B0DB8	B0DF4	B0FW4	B0DH6
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500				73 JN	
BHC, beta			3	6.8 J (C)				
DDE-4,4	50000	9000	54000	8.2 J	15000 J (B)		170	16 J
Dieldrin	50000	180	4			4 JN (C)	120 JN (C)	18 NJ (C)
Pcb-araclor 1254		2000			19000 (B)		3200 J (B)	410
Pcb-araclor 1260		2000				1300		220 NJ

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-5
Subsurface Soil - Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-12S	MA-MW-13S	MA-MW-14S	MA-MW-15S	MA-MW-16S
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-12S-S	MA-MW-13S-S	MA-MW-14S-S-9D	MA-MW-15S-S	MA-MW-16S-S
Sample Date				10/30/2001	10/30/2001	01/10/2002	10/29/2001	10/29/2001
Sample Interval				5.4 - 15.4 ft	6.6 - 16.6 ft	7 - 20 ft	6.8 - 16.8 ft	6.5 - 16.5 ft
CLP Sample ID				B0AW8	B0AX0	B0G08	B0DH0	B0DF8
Chemical Name								
Volatile Organic Compounds (ug/Kg)								
Benzene	1000	13000	30	2 J	210 (C)		1 J	7 J
Bromomethane	1000	1000000	200					
Chloroform	1000	28000	600					5 J
Dichloroethene-1,2 trans	50000		700	52		5 J		1 J
Dichloroethylene-1,1	10000		60					
Dichloroethylene-1,2 cis	1000	1000000	400	260	12 J	89	5 J	70
Ethylbenzene	100000	1000000	13000	8 J	5 J		1 J	
Methylene chloride	1000		20	140 (C)				
Tetrachloroethylene	1000	6000	60	1100 J (AC)		2100 (C)	69 (C)	130 (C)
Toluene	500000	1000000	12000	2900 J				19
Trichlorobenzene-1,2,4	100000		5000					
Trichloroethane-1,1,1	50000		2000	19		3 J		270 J
Trichloroethylene	1000	54000	60	230 (C)	1 J	14 J	24	38
Vinyl chloride	10000	7000	10		15 (C)			
Xylenes, total	67000		210000	83	48		5 J	1 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-5
Subsurface Soil - Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-18S	MA-MW-18S	MA-SB-02	MA-SB-04	MA-SB-06
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-18S-S-5	MA-MW-18S-S-5D	MA-SB02-S	MA-SB04-S	MA-SB06-S
Sample Date				11/06/2001	11/06/2001	10/18/2001	10/16/2001	10/15/2001
Sample Interval				7.8 - 17.8 ft	7.8 - 17.8 ft	4.5 - 5 ft	5 - 5.5 ft	5 - 5.5 ft
CLP Sample ID				B0AX5	B0AX6	B0DD5	B0DA7	B0D97
Chemical Name								
Volatile Organic Compounds (ug/Kg)								
Benzene	1000	13000	30	67 J (C)	190 J (C)		3 J	
Bromomethane	1000	1000000	200					520 J (C)
Chloroform	1000	28000	600					
Dichloroethene-1,2 trans	50000		700				13	
Dichloroethylene-1,1	10000		60		1 J			
Dichloroethylene-1,2 cis	1000	1000000	400			6 J	140	
Ethylbenzene	100000	1000000	13000		1 J		5 J	
Methylene chloride	1000		20					
Tetrachloroethylene	1000	6000	60			470 J (C)	16	
Toluene	500000	1000000	12000		3 J		26	290 J
Trichlorobenzene-1,2,4	100000		5000					
Trichloroethane-1,1,1	50000		2000			4 J		
Trichloroethylene	1000	54000	60			9 J	7 J	
Vinyl chloride	10000	7000	10				59 J (C)	
Xylenes, total	67000		210000				31	

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-5
Subsurface Soil - Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-08	MA-SB-11	MA-SB-112	MA-SB-118	MA-SB-122
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB08-S	MA-SB11-S	MA-SB112-S	MA-SB118-S	MA-SB122-S
Sample Date				10/16/2001	10/15/2001	10/17/2001	10/18/2001	10/16/2001
Sample Interval				6.5 - 7 ft	N/A	4 - 4.5 ft	4.5 - 5 ft	8 - 8.5 ft
CLP Sample ID				B0DA8	B0D92	B0DC2	B0DD6	B0DB2
Chemical Name								
Volatile Organic Compounds (ug/Kg)								
Benzene	1000	13000	30	260 (C)		2 J		6 J
Bromomethane	1000	1000000	200					
Chloroform	1000	28000	600					
Dichloroethene-1,2 trans	50000		700	5 J	1600 (C)			
Dichloroethylene-1,1	10000		60		130 J (C)			
Dichloroethylene-1,2 cis	1000	1000000	400	29	13000 (AC)	7 J	15	9 J
Ethylbenzene	100000	1000000	13000	120		5 J		7 J
Methylene chloride	1000		20					
Tetrachloroethylene	1000	6000	60			270 (C)	320 J (C)	4 J
Toluene	500000	1000000	12000	79		12 J	17	37
Trichlorobenzene-1,2,4	100000		5000					
Trichloroethane-1,1,1	50000		2000	2 J		5 J	12 J	
Trichloroethylene	1000	54000	60	1 J	630000 (ABC)	71 (C)	17	3 J
Vinyl chloride	10000	7000	10		480 J (C)			12 J (C)
Xylenes, total	67000		210000	250	250 J	21		38

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-5
Subsurface Soil - Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-124	MA-SB-130	MA-SB-14	MA-SB-42	MA-SB-47
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB124-S	MA-SB130-S	MA-SB14-S	MA-SB42-S	MA-SB47-S
Sample Date				10/17/2001	10/17/2001	10/15/2001	10/18/2001	10/18/2001
Sample Interval				4 - 4.5 ft	5 - 5.5 ft	9 - 9.5 ft	4.5 - 5 ft	4.5 - 5 ft
CLP Sample ID				B0DB5	B0DC1	B0D98	B0DC7	B0DC8
Chemical Name								
Volatile Organic Compounds (ug/Kg)								
Benzene	1000	13000	30		4 J			
Bromomethane	1000	1000000	200					
Chloroform	1000	28000	600	10 J				280 J
Dichloroethene-1,2 trans	50000		700					
Dichloroethylene-1,1	10000		60					
Dichloroethylene-1,2 cis	1000	1000000	400	3 J		60	2 J	11000 (AC)
Ethylbenzene	100000	1000000	13000	2 J	2400 J			
Methylene chloride	1000		20	43 (C)	110 (C)			
Tetrachloroethylene	1000	6000	60	58	6 J	8 J	450 J (C)	110000 (ABC)
Toluene	500000	1000000	12000	19	16 J	6 J		
Trichlorobenzene-1,2,4	100000		5000					
Trichloroethane-1,1,1	50000		2000	4 J	6 J		7 J	250 J
Trichloroethylene	1000	54000	60	33		220 (C)	32	20000 (AC)
Vinyl chloride	10000	7000	10					
Xylenes, total	67000		210000	17	6200			

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-5
Subsurface Soil - Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-56	MA-SB-60	MA-SO-201
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB56-S	MA-SB60-S	MA-SO201-S
Sample Date				10/16/2001	10/16/2001	10/17/2001
Sample Interval				8.5 - 9 ft	6.5 - 7 ft	4.5 - 5 ft
CLP Sample ID				B0DA1	B0DA2	B0DB6
Chemical Name						
Volatile Organic Compounds (ug/Kg)						
Benzene	1000	13000	30	76 (C)	700 J (C)	31000 (ABC)
Bromomethane	1000	1000000	200			
Chloroform	1000	28000	600			16000 (AC)
Dichloroethene-1,2 trans	50000		700			
Dichloroethylene-1,1	10000		60			
Dichloroethylene-1,2 cis	1000	1000000	400	6 J		
Ethylbenzene	100000	1000000	13000	84	9800	29000 (C)
Methylene chloride	1000		20			
Tetrachloroethylene	1000	6000	60	13		43000 (ABC)
Toluene	500000	1000000	12000	590 J	2600	49000 (C)
Trichlorobenzene-1,2,4	100000		5000			14000 J (C)
Trichloroethane-1,1,1	50000		2000			3300 J (C)
Trichloroethylene	1000	54000	60	63 (C)		15000 (AC)
Vinyl chloride	10000	7000	10			
Xylenes, total	67000		210000	380	54000	220000 (AC)

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-6
Subsurface Soil - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-12S	MA-MW-15S	MA-MW-16S	MA-MW-18S	MA-MW-18S
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-12S-S	MA-MW-15S-S	MA-MW-16S-S	MA-MW-18S-S-5	MA-MW-18S-S-5D
Sample Date				10/30/2001	10/29/2001	10/29/2001	11/06/2001	11/06/2001
Sample Interval				5.4 - 15.4 ft	6.8 - 16.8 ft	6.5 - 16.5 ft	7.8 - 17.8 ft	7.8 - 17.8 ft
CLP Sample ID				B0AW8	B0DH0	B0DF8	B0AX5	B0AX6
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	5700 (BC)	4700 J (BC)	1100 J	1500 J	1900 J
Benzo(a)pyrene	100000	660	8000	5100 (B)	3900 J (B)	920 J (B)	930 J (B)	1000 J (B)
Benzo(b)fluoranthene	50000	4000	5000	6200 (BC)	4200 J (B)	970 J	1500 J	2000 J
Benzo(k)fluoranthene	500000	4000	49000	2900	2700 J	860 J	1200 J	1900 J
Carbazole			600	410	690 J (C)	130 J	190 J	240 J
Chrysene	500000	40000	160000	6100	3500 J	1200 J	1400 J	1700 J
Dibenzo(a,h)anthracene	100000	660	2000	800 (B)	650 J	200 J	220 J	310 J
Dichlorobenzidine-3,3	100000		7					
Fluoranthene	100000	10000000	4300000	9400	9100 J	2100 J	3100 J	4100 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	1900 J	1900 J	620 J	730 J	840 J
Isophorone	50000		500					
Naphthalene	100000	4200000	84000	64 J	460 J	250 J		
Nitrosodiphenylamine-n	100000		1000					
Phthalate, di-n-butyl	100000		2300000					
Pyrene	100000	10000000	4200000	8700	8000 J	1800 J	2200 J	2500 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-6
Subsurface Soil - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-02	MA-SB-04	MA-SB-06	MA-SB-08	MA-SB-09
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB02-S	MA-SB04-S	MA-SB06-S	MA-SB08-S	MA-SB09-S
Sample Date				10/18/2001	10/16/2001	10/15/2001	10/16/2001	10/15/2001
Sample Interval				4.5 - 5 ft	5 - 5.5 ft	5 - 5.5 ft	6.5 - 7 ft	3 - 3.5 ft
CLP Sample ID				B0DD5	B0DA7	B0D97	B0DA8	B0D90
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	8000 (BC)	13000 (BC)	1400 J	920 J	3100 (C)
Benzo(a)pyrene	100000	660	8000	9500 (BC)	13000 (BC)	1700 J (B)	1000 J (B)	3400 J (B)
Benzo(b)fluoranthene	50000	4000	5000	13000 (BC)	17000 (BC)	2400 J	1400 J	5100 J (BC)
Benzo(k)fluoranthene	500000	4000	49000	5300 (B)	9500 (B)	910 J	630 J	2200
Carbazole			600	1400 (C)	2900 J (C)	210 J	200 J	800 (C)
Chrysene	500000	40000	160000	8700	13000	1700 J	1100 J	3900 J
Dibenzo(a,h)anthracene	100000	660	2000	1200 (B)	3300 J (BC)	300 J	330 J	730 (B)
Dichlorobenzidine-3,3	100000		7					
Fluoranthene	100000	1000000	4300000	21000	25000	2500 J	2300 J	7600 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	6100 (B)	8200 (B)	1100 J	730 J	2300
Isophorone	50000		500					940 (C)
Naphthalene	100000	4200000	84000	1400	760 J	10000 J	2200 J	89000 (C)
Nitrosodiphenylamine-n	100000		1000			200 J	500 J	
Phthalate, di-n-butyl	100000		2300000					92000
Pyrene	100000	10000000	4200000	18000	24000	2100 J	1400 J	6700 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-6
Subsurface Soil - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-106	MA-SB-108	MA-SB-120	MA-SB-124	MA-SB-130
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB106-S	MA-SB108-S	MA-SB120-S	MA-SB124-S	MA-SB130-S
Sample Date				10/22/2001	10/22/2001	10/19/2001	10/17/2001	10/17/2001
Sample Interval				5 - 5.5 ft	4.5 - 5 ft	2 - 2.5 ft	4 - 4.5 ft	5 - 5.5 ft
CLP Sample ID				B0DG8	B0DG0	B0DE7	B0DB5	B0DC1
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	5900 (BC)	20000 (BC)		2000 (C)	1600
Benzo(a)pyrene	100000	660	8000	5000 (B)	12000 (BC)		1700 (B)	1400 (B)
Benzo(b)fluoranthene	50000	4000	5000	5400 (BC)	11000 (BC)		2000	1600
Benzo(k)fluoranthene	500000	4000	49000	4000 (B)	11000 (B)		1200	1100
Carbazole			600	390 J	3200 (C)		400 J	600 (C)
Chrysene	500000	40000	160000	5700	20000		2100	1700
Dibenzo(a,h)anthracene	100000	660	2000	1200 J (B)	1900 J (B)		280 J	250 J
Dichlorobenzidine-3,3	100000		7					
Fluoranthene	100000	10000000	4300000	8900	43000	370 J	3500 J	4400
Indeno(1,2,3-cd)pyrene	500000	4000	14000	3100 J	6300 J (B)		1000	760
Isophorone	50000		500					
Naphthalene	100000	4200000	84000	440	1200		430	29000
Nitrosodiphenylamine-n	100000		1000					1700 (C)
Phthalate, di-n-butyl	100000		2300000	83 J	110 J	130000 J (A)	380 J	28 J
Pyrene	100000	10000000	4200000	11000	52000		2800	4000

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
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Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-6
Subsurface Soil - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-29	MA-SB-31	MA-SB-56	MA-SB-60	MA-SB-62
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB29-S-5.0	MA-SB31-S	MA-SB56-S	MA-SB60-S	MA-SB62-S-5.0
Sample Date				12/12/2001	10/17/2001	10/16/2001	10/16/2001	12/12/2001
Sample Interval				5 - 5.5 ft	6.5 - 7 ft	8.5 - 9 ft	6.5 - 7 ft	5 - 5.5 ft
CLP Sample ID				B0DX7	B0DC3	B0DA1	B0DA2	B0DX2
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	1400 J	27000 (BC)	970		
Benzo(a)pyrene	100000	660	8000	1400 J (B)	24000 (BC)	720 (B)		1400 J (B)
Benzo(b)fluoranthene	50000	4000	5000		36000 (BC)	830		1600 J
Benzo(k)fluoranthene	500000	4000	49000	1300 J		570		1600 J
Carbazole			600		2000 J (C)	100 J		
Chrysene	500000	40000	160000	1700 J	28000	910		1800 J
Dibenzo(a,h)anthracene	100000	660	2000		4100 J (BC)	140 J		
Dichlorobenzidine-3,3	100000		7					
Fluoranthene	100000	10000000	4300000	2600 J	49000	1400		3500 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000		14000 (BC)	410 J		
Isophorone	50000		500					
Naphthalene	100000	4200000	84000		3000 J	750	120000 J (AC)	
Nitrosodiphenylamine-n	100000		1000					
Phthalate, di-n-butyl	100000		2300000					
Pyrene	100000	10000000	4200000	2600 J	60000	1300		2800 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-6
Subsurface Soil - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ

Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-67	MA-SB-68	MA-SB-69	MA-SB-75	MA-SB-81
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB67-S-5.0	MA-SB68-S-4.5	MA-SB69-S-2.0	MA-SB75-S-4.5	MA-SB81-S
Sample Date				12/12/2001	12/13/2001	12/12/2001	12/12/2001	10/18/2001
Sample Interval				5 - 5.5 ft	4.5 - 5 ft	2 - 2.5 ft	4.5 - 5 ft	4.5 - 5 ft
CLP Sample ID				B0DX3	B0DY8	B0DW8	B0DX0	B0DE0
Chemical Name								
Semivolatile Organic Compounds (ug/Kg)								
Benzo(a)anthracene	500000	4000	2000	2200 J (C)	1800 J	1500 J	150000 J (BC)	5400 (BC)
Benzo(a)pyrene	100000	660	8000	2100 J (B)	2200 J (B)	1200 J (B)	150000 J (ABC)	4800 (B)
Benzo(b)fluoranthene	50000	4000	5000	1800 J	1900 J	1100 J	150000 J (ABC)	6600 (BC)
Benzo(k)fluoranthene	500000	4000	49000	2300 J	2000 J	1000 J	140000 J (BC)	2200
Carbazole			600			210 J	68000 J (C)	1900 (C)
Chrysene	500000	40000	160000	2600 J	2200 J	1700 J	180000 J (BC)	5600
Dibenzo(a,h)anthracene	100000	660	2000	420 J		200 J	22000 J (BC)	690 J (B)
Dichlorobenzidine-3,3	100000		7					
Fluoranthene	100000	10000000	4300000	4000 J	2400 J	3000 J	420000 J (A)	14000
Indeno(1,2,3-cd)pyrene	500000	4000	14000	1100 J	1400 J	580 J	68000 J (BC)	2600
Isophorone	50000		500					
Naphthalene	100000	4200000	84000				76000 J	780
Nitrosodiphenylamine-n	100000		1000					
Phthalate, di-n-butyl	100000		2300000					41 J
Pyrene	100000	10000000	4200000	3700 J	2300 J	3200 J	350000 J (A)	12000

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-6
Subsurface Soil - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-82	MA-SO-209	MA-SO-303
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB82-S	MA-SO209-S	MA-SO303-S-6.0
Sample Date				10/19/2001	10/22/2001	12/13/2001
Sample Interval				4 - 4.5 ft	5 - 5.5 ft	6 - 6.5 ft
CLP Sample ID				B0DE3	B0DH7	B0DY4
Chemical Name						
Semivolatile Organic Compounds (ug/Kg)						
Benzo(a)anthracene	500000	4000	2000	5000 (BC)	58 J	9200 J (BC)
Benzo(a)pyrene	100000	660	8000	4900 (B)	63 J	7000 J (B)
Benzo(b)fluoranthene	50000	4000	5000	6300 (BC)	67 J	6400 J (BC)
Benzo(k)fluoranthene	500000	4000	49000	2000	67 J	5700 J (B)
Carbazole			600	690 J (C)		2000 J (C)
Chrysene	500000	40000	160000	6100	76 J	8700 J
Dibenzo(a,h)anthracene	100000	660	2000	770 J (B)		800 J (B)
Dichlorobenzidine-3,3	100000		7		350 J (C)	
Fluoranthene	100000	10000000	4300000	9900	82 J	15000 J
Indeno(1,2,3-cd)pyrene	500000	4000	14000	2900	49 J	1800 J
Isophorone	50000		500			
Naphthalene	100000	4200000	84000	1300 J		1200 J
Nitrosodiphenylamine-n	100000		1000			
Phthalate, di-n-butyl	100000		2300000	40 J		
Pyrene	100000	10000000	4200000	11000	90 J	14000 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-12S	MA-MW-13S	MA-MW-14S	MA-MW-14S	MA-MW-16S
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-12S-S	MA-MW-13S-S	MA-MW-14S-S-9	MA-MW-14S-S-9D	MA-MW-16S-S
Sample Date				10/30/2001	10/30/2001	01/10/2002	01/10/2002	10/29/2001
Sample Interval				5.4 - 15.4 ft	6.6 - 16.6 ft	7 - 20 ft	7 - 20 ft	6.5 - 16.5 ft
CLP Sample ID				MB0990	MB0985	MB0EY6	MB0EY3	MB0988
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5			6 BJ (C)	9.5 BJ (C)	5.8 B (C)
Arsenic		20	29	19	31.8 (BC)	32 (BC)	46.8 (BC)	129 (BC)
Barium		47000	1600	376	7880 (C)	18.5 B	27.8 B	2080 (C)
Cadmium		100	8	8.1 (C)	8.1 (C)			0.46 B
Chromium		20	38	71.9 (BC)	30.3 (B)	20 (B)	20.8 (B)	1080 (BC)
Copper		600		53.1	29.7	13.4	17.6	44.8
Lead		600		239	324	116	155	278
Selenium			5	1.4	5.2 (C)	0.95 BJ		
Zinc		1500	12000	341	3140 (B)	23.1	21.5	364

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-17S	MA-MW-18S	MA-MW-18S	MA-MW-19S	MA-MW-21S
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-17S-S-4.5	MA-MW-18S-S-5	MA-MW-18S-S-5D	MA-MW-19S-S-3	MA-MW-21S-S-10
Sample Date				11/07/2001	11/06/2001	11/06/2001	11/06/2001	01/10/2002
Sample Interval				8 - 18 ft	7.8 - 17.8 ft	7.8 - 17.8 ft	5.05 - 15.05 ft	10 - 21 ft
CLP Sample ID				MB09M2	MB0982	MB0983	MB0984	MB0EY4
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	4.3 B				1.3 BJ
Arsenic		20	29	11.9	10.5	7.4	14.4	7.2
Barium		47000	1600	4090 (C)	24400 (C)	13300 (C)	14600 (C)	137
Cadmium		100	8	6.7	0.95 B	0.54 B	5.3	0.33 B
Chromium		20	38	20.1 (B)	56.2 (BC)	14.6	7.8	30.1 (B)
Copper		600		127	104	92.8	113	17.5
Lead		600		786 (B)	380	330	3370 (B)	277
Selenium			5					
Zinc		1500	12000	641 J	1170 J	982 J	2750 J (B)	340

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-02	MA-SB-04	MA-SB-06	MA-SB-08	MA-SB-09
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB02-S	MA-SB04-S	MA-SB06-S	MA-SB08-S	MA-SB09-S
Sample Date				10/18/2001	10/16/2001	10/15/2001	10/16/2001	10/15/2001
Sample Interval				4.5 - 5 ft	5 - 5.5 ft	5 - 5.5 ft	6.5 - 7 ft	3 - 3.5 ft
CLP Sample ID				MB0CJ3	MB0CG2	MB0CF1	MB0CF8	MB0CE6
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5		1.2 BJ	41 J (C)	5.6 BJ (C)	5.4 BJ (C)
Arsenic		20	29	148 (BC)	34.4 (BC)	920 J (BC)	4340 (BC)	39.5 (BC)
Barium		47000	1600	991	615	17600 J (C)	989	333
Cadmium		100	8	1 B	1.6	18.5 J (C)	0.84 B	1 B
Chromium		20	38	30.3 (B)	34.7 (B)	21300 J (BC)	44.1 (BC)	129 (BC)
Copper		600		30.6	46.9	603 J (B)	37.2	67.9
Lead		600		647 (B)	211	1140 J (B)	103	715 (B)
Selenium			5	1.3		3.1 J		1.3
Zinc		1500	12000	411	179 J	3790 J (B)	170 J	228 J

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-106	MA-SB-108	MA-SB-11	MA-SB-112	MA-SB-118
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB106-S	MA-SB108-S	MA-SB11-S	MA-SB112-S	MA-SB118-S
Sample Date				10/22/2001	10/22/2001	10/15/2001	10/17/2001	10/18/2001
Sample Interval				5 - 5.5 ft	4.5 - 5 ft	N/A	4 - 4.5 ft	4.5 - 5 ft
CLP Sample ID				MB0CM0	MB0CL3	MB0CF0	MB0CG6	MB0CJ4
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	1.3 B	2.2 B	1.4 BJ	4.1 BJ	2.1 BJ
Arsenic		20	29	10.6	15.9	165 (BC)	78.9 (BC)	280 (BC)
Barium		47000	1600	9450 J (C)	18300 J (C)	4320 (C)	498	1450
Cadmium		100	8	8 (C)	5.7	0.59 B	6	1.7
Chromium		20	38	8.6	22.4 (B)	224 (BC)	293 (BC)	631 (BC)
Copper		600		92	97.6	38.4	235	81
Lead		600		4800 (B)	9950 (B)	864 (B)	716 (B)	239
Selenium			5	1.7 J	2 J	4.1	1.9	2.2
Zinc		1500	12000	4250 (B)	1770 (B)	196 J	1040	354

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-120	MA-SB-122	MA-SB-124	MA-SB-13	MA-SB-130
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB120-S	MA-SB122-S	MA-SB124-S	MA-SB13-S	MA-SB130-S
Sample Date				10/19/2001	10/16/2001	10/17/2001	10/19/2001	10/17/2001
Sample Interval				2 - 2.5 ft	8 - 8.5 ft	4 - 4.5 ft	8.5 - 9 ft	5 - 5.5 ft
CLP Sample ID				MB0CK3	MB0CG4	MB0CG8	MB0CL1	MB0CH3
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	1.8 BJ	19.4 BJ (C)	1.4 BJ		19.8 BJ (C)
Arsenic		20	29	24.7 J (B)	4470 (BC)	120 (BC)	31.3 J (BC)	3390 J (BC)
Barium		47000	1600	925	785	15900 (C)	133	1270 J
Cadmium		100	8	2.4	0.56 B	1.6		3.8 J
Chromium		20	38	21.7 (BC)	268 (BC)	177.0 (BC)	205 (BC)	2300 J (BC)
Copper		600		86.8	37.5	90.8	53.6	554 J
Lead		600		538	183	435	158	287 J
Selenium			5	1.2 B		2.3		
Zinc		1500	12000	560	328 J	596	54.6	1430 J

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-131	MA-SB-14	MA-SB-29	MA-SB-31	MA-SB-42
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB131-S	MA-SB14-S	MA-SB29-S-5.0	MA-SB31-S	MA-SB42-S
Sample Date				10/19/2001	10/15/2001	12/12/2001	10/17/2001	10/18/2001
Sample Interval				5 - 5.5 ft	9 - 9.5 ft	5 - 5.5 ft	6.5 - 7 ft	4.5 - 5 ft
CLP Sample ID				MB0CK6	MB0CE8	MB0CZ7	MB0CH4	MB0CH7
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5			2.3 J	1.3 BJ	
Arsenic		20	29	198 J (BC)	11.3	55.4 (BC)	164 (BC)	47.1 (BC)
Barium		47000	1600	18500 (C)	6390 (C)	504 J	654	233
Cadmium		100	8	4.4	0.98 B	1.1 B	0.12 B	0.39 B
Chromium		20	38	23.6 (B)	132 (BC)	33 J (B)	493 (BC)	18.2
Copper		600		40.2	15.4	235	94.7	2590 (B)
Lead		600		352	64.3	1320 (B)	334	219
Selenium			5	2.7		1.4	1.2 B	1.6
Zinc		1500	12000	2330 (B)	319 J		64.2	119

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-47	MA-SB-56	MA-SB-60	MA-SB-66	MA-SB-68
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB47-S	MA-SB56-S	MA-SB60-S	MA-SB66-S-4.5	MA-SB68-S-4.5
Sample Date				10/18/2001	10/16/2001	10/16/2001	12/13/2001	12/13/2001
Sample Interval				4.5 - 5 ft	8.5 - 9 ft	6.5 - 7 ft	4.5 - 5 ft	4.5 - 5 ft
CLP Sample ID				MB0CH8	MB0CF5	MB0CF6	MB0D12	MB0D08
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5			21 J (C)		4.6 BJ
Arsenic		20	29	18.1	65.5 (BC)	23300 (BC)	19.2 J	17.4 J
Barium		47000	1600	63.3	1620 (C)	2180 (C)	15600 (C)	366
Cadmium		100	8	0.22 B	1 B	1 B	2.6	0.61 B
Chromium		20	38	77.6 (BC)	49 (BC)	373 (BC)	42.3 (BC)	65.8 (BC)
Copper		600		908 (B)	68.9	35.4	210	93.9
Lead		600		69.9	159	244	256	2330 (B)
Selenium			5			2.5		4
Zinc		1500	12000	124	182 J	635 J	1810 (B)	397

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-69	MA-SB-71	MA-SB-72	MA-SB-75	MA-SB-81
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB69-S-2.0	MA-SB71-S-6.0	MA-SB72-S-6.0	MA-SB75-S-4.5	MA-SB81-S
Sample Date				12/12/2001	12/13/2001	12/13/2001	12/12/2001	10/18/2001
Sample Interval				2 - 2.5 ft	6 - 6.5 ft	6 - 6.5 ft	4.5 - 5 ft	4.5 - 5 ft
CLP Sample ID				MB0980	MB0D17	MB0D14	MB0CZ3	MB0CJ8
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	3.8 J		7.2 BJ (C)		
Arsenic		20	29	18	224 J (BC)	61 J (BC)	20 (B)	297 J (BC)
Barium		47000	1600	1800 J (C)	4780 (C)	6680 (C)	1160 J	12300 (C)
Cadmium		100	8	2.5	0.4 B	1.2 B	291 (BC)	7.8
Chromium		20	38	22.2 J (B)	27.9 (B)	18.4	30 J (B)	32.4 (B)
Copper		600		330	49.1	45.6	108	58.7
Lead		600		2340 (B)	163	720 (B)	731 (B)	436
Selenium			5	2.3		2.7		
Zinc		1500	12000		218	374	9500 (B)	5960 (B)

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-82	MA-SB-96	MA-SB-97	MA-SB-98	MA-SO-201
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB82-S	MA-SB96-S	MA-SB97-S	MA-SB98-S	MA-SO201-S
Sample Date				10/19/2001	10/22/2001	10/22/2001	10/22/2001	10/17/2001
Sample Interval				4 - 4.5 ft	4.5 - 5 ft	4.5 - 5 ft	5 - 5.5 ft	4.5 - 5 ft
CLP Sample ID				MB0CK4	MB0CL8	MB0CL6	MB0CM2	MB0CG9
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5		1.7 B	0.9 B		2 BJ
Arsenic		20	29	25 J (B)	22.7 (B)	49.4 (BC)	1780 (BC)	60.3 (BC)
Barium		47000	1600	1330	2460 J (C)	14000 J (C)	1870 J (C)	14900 (C)
Cadmium		100	8	4.5		0.4 B	1.3	7.4
Chromium		20	38	69.8 (BC)	11.6	65.9 (BC)	110 (BC)	1730 (BC)
Copper		600		40.8	34	40.5	242	367
Lead		600		339	2650 (B)	409	1270 (B)	842 (B)
Selenium			5		1.8 J	1.4 J	1.3 J	1.8
Zinc		1500	12000	542	501	469	511	734

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-203	MA-SO-207	MA-SO-208	MA-SO-210	MA-SO-211
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO203-S	MA-SO207-S	MA-SO208-S	MA-SO210-S-5.0	MA-SO211-S-4.5
Sample Date				10/19/2001	10/22/2001	10/22/2001	12/14/2001	12/14/2001
Sample Interval				4 - 4.5 ft	4.5 - 5 ft	4.5 - 5 ft	5 - 5.5 ft	4.5 - 5 ft
CLP Sample ID				MB0CK7	MB0CM1	MB0CM5	MB0ER6	MB0ER5
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5		1 B	1.9 B		
Arsenic		20	29	48.6 J (BC)	133 (BC)	13.5	1240 J (BC)	7.2 J
Barium		47000	1600	39700 (C)	70.6 J	10200 J (C)	14000 (C)	11900 (C)
Cadmium		100	8	1.6		3.8	22.6 (C)	1.5
Chromium		20	38	128 (BC)	45 (BC)	18	5.9	5.6
Copper		600		40.3	363	70.5	41.9	13.6
Lead		600		277	48.2	525	223	322
Selenium			5	1.9		3 J	3.1	1.4
Zinc		1500	12000	1560 (B)	321	1520 (B)	1960 (B)	273

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-212	MA-SO-213	MA-SO-214	MA-SO-302	MA-SO-303
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SO212-S-5.0	MA-SO213-S-5.5	MA-SO214-S	MA-SO302-S-6.0	MA-SO303-S-6.0
Sample Date				12/14/2001	12/14/2001	10/18/2001	12/12/2001	12/13/2001
Sample Interval				5 - 5.5 ft	5.5 - 6 ft	4 - 4.5 ft	6 - 6.5 ft	6 - 6.5 ft
CLP Sample ID				MB0ER8	MB0ES2	MB0CH9	MB09M3	MB0D01
Chemical Name								
Metals (mg/Kg)								
Antimony		340	5	1.2 BJ				
Arsenic		20	29	16.6 J	479 J (BC)	5.6	7.1	236 (BC)
Barium		47000	1600	18500 (C)	10300 (C)	444	5010 J (C)	109 J
Cadmium		100	8	24.8 (C)	1.1 B		3	0.18 B
Chromium		20	38	17.5	14.2	57.7 (BC)	34.3 J (B)	16.8 J
Copper		600		36.5	12.6	13.3	64.3	13.6
Lead		600		51.8	38.1	81.3	363	169
Selenium			5	2.5	2.7		1.8	
Zinc		1500	12000	1340	672	102		

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-7
Subsurface Soil - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-404
Sample ID	IGWSCC	NRDCSCC	EPASSLDA	MA-SO404-S-8.5
Sample Date			F20	12/17/2001
Sample Interval				8.5 - 9 ft
CLP Sample ID				MB0ES6
Chemical Name				
Metals (mg/Kg)				
Antimony		340	5	
Arsenic		20	29	1.5 B
Barium		47000	1600	1820 (C)
Cadmium		100	8	
Chromium		20	38	7.8
Copper		600		5.1
Lead		600		35.3
Selenium			5	
Zinc		1500	12000	115

B - Analyte detected in associated blank
J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-8
Subsurface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-12S	MA-MW-13S	MA-MW-14S	MA-MW-16S	MA-MW-17S
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-12S-S	MA-MW-13S-S	MA-MW-14S-S-9	MA-MW-16S-S	MA-MW-17S-S-4.5
Sample Date				10/30/2001	10/30/2001	01/10/2002	10/29/2001	11/07/2001
Sample Interval				5.4 - 15.4 ft	6.6 - 16.6 ft	7 - 20 ft	6.5 - 16.5 ft	8 - 18 ft
CLP Sample ID				B0AW8	B0AX0	B0G11	B0DF8	B0AY0
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500	5 NJ				
BHC, alpha			0.5		1.9 J (C)			
BHC, beta			3		3.9 (C)			2.2 NJ
BHC, gamma (Lindane)	50000		9		1.3 J		12 J (C)	
DDE-4,4	50000	9000	54000	11 J	450 J	140 JN	30 J	47 J
Dieldrin	50000	180	4	26 J (C)			11 NJ (C)	27 NJ (C)
Heptachlor Epoxide			700		7.8 NJ			4.1 NJ
Pcb-araclor 1254		2000				2400 J (B)		
Pcb-araclor 1260		2000						

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-8
Subsurface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-MW-18S	MA-MW-18S	MA-SB-08	MA-SB-09	MA-SB-108
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-MW-18S-S-5	MA-MW-18S-S-5D	MA-SB08-S	MA-SB09-S	MA-SB108-S
Sample Date				11/06/2001	11/06/2001	10/16/2001	10/15/2001	10/22/2001
Sample Interval				7.8 - 17.8 ft	7.8 - 17.8 ft	6.5 - 7 ft	3 - 3.5 ft	4.5 - 5 ft
CLP Sample ID				B0AX5	B0AX6	B0DA8	B0D90	B0DG0
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500			120 JN		
BHC, alpha			0.5					
BHC, beta			3				28 J (C)	
BHC, gamma (Lindane)	50000		9			34 J (C)		
DDE-4,4	50000	9000	54000	4.4 J	5.5 J	210	520	10
Dieldrin	50000	180	4	9.5 NJ (C)	13 NJ (C)		330 J (BC)	5.7 NJ (C)
Heptachlor Epoxide			700	6 NJ	6.6 NJ			
Pcb-araclor 1254		2000		200 NJ	250 NJ	2300 (B)	17000 (B)	
Pcb-araclor 1260		2000				1700	3800 (B)	

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-8
Subsurface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-112	MA-SB-118	MA-SB-120	MA-SB-124	MA-SB-13
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB112-S	MA-SB118-S	MA-SB120-S	MA-SB124-S	MA-SB13-S
Sample Date				10/17/2001	10/18/2001	10/19/2001	10/17/2001	10/19/2001
Sample Interval				4 - 4.5 ft	4.5 - 5 ft	2 - 2.5 ft	4 - 4.5 ft	8.5 - 9 ft
CLP Sample ID				B0DC2	B0DD6	B0DE7	B0DB5	B0DF6
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500				240 (B)	
BHC, alpha			0.5					
BHC, beta			3					5.8 JN (C)
BHC, gamma (Lindane)	50000		9					
DDE-4,4	50000	9000	54000			52 JN	740	
Dieldrin	50000	180	4	68 J (C)	6 JN (C)	98 J (C)	690 (BC)	
Heptachlor Epoxide			700					
Pcb-araclor 1254		2000						
Pcb-araclor 1260		2000				3100 J (B)	1600	

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-8
Subsurface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SB-131	MA-SB-31	MA-SB-47	MA-SB-56	MA-SB-60
Sample ID	IGWSCC	NRDCSCC	EPASSLDA F20	MA-SB131-S	MA-SB31-S	MA-SB47-S	MA-SB56-S	MA-SB60-S
Sample Date				10/19/2001	10/17/2001	10/18/2001	10/16/2001	10/16/2001
Sample Interval				5 - 5.5 ft	6.5 - 7 ft	4.5 - 5 ft	8.5 - 9 ft	6.5 - 7 ft
CLP Sample ID				B0DF1	B0DC3	B0DC8	B0DA1	B0DA2
Chemical Name								
Pesticides and PCBs (ug/Kg)								
Aldrin	50000	170	500					
BHC, alpha			0.5	2 J (C)				
BHC, beta			3		49 (C)	3.8 J (C)	13 J (C)	5.9 JN (C)
BHC, gamma (Lindane)	50000		9					
DDE-4,4	50000	9000	54000	94				
Dieldrin	50000	180	4			5.6 (C)		
Heptachlor Epoxide			700					
Pcb-araclor 1254		2000						
Pcb-araclor 1260		2000						

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup
Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-8
Subsurface Soil - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	(C)	MA-SO-201	MA-SO-203	MA-SO-204	MA-SO-214
Sample ID	IGWSCC	NRDCSCC	EPASSLDA	MA-SO201-S	MA-SO203-S	MA-SO204-S-5.0	MA-SO214-S
Sample Date			F20	10/17/2001	10/19/2001	12/17/2001	10/18/2001
Sample Interval				4.5 - 5 ft	4 - 4.5 ft	5 - 5.5 ft	4 - 4.5 ft
CLP Sample ID				B0DB6	B0DF2	B0FW6	B0DC9
Chemical Name							
Pesticides and PCBs (ug/Kg)							
Aldrin	50000	170	500		23 JN	40 JN	
BHC, alpha			0.5				
BHC, beta			3			15 NJ (C)	3 J (C)
BHC, gamma (Lindane)	50000		9				
DDE-4,4	50000	9000	54000	19000 (B)	610 JN	92 J	
Dieldrin	50000	180	4		440 (BC)	47 NJ (C)	
Heptachlor Epoxide			700		900 JN (C)		
Pcb-araclor 1254		2000		48000 (B)		2100 (B)	
Pcb-araclor 1260		2000					

J - Reported value estimated in quantity
N - Quality control sample spike recovery for this analyte was outside specified limits
(A, B, C) - Exceeds criteria
Exceedences highlighted

IGWSCC - Impact to Groundwater Soil Cleanup Criteria
NRDCSCC - Nonresidential Direct Contact Soil Cleanup Criteria
EPASSLDAF20 - EPA Region 9 Soil Cleanup Criteria

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-10S	MA-MW-11M	MA-MW-11M	MA-MW-11S	MA-MW-12M
Sample ID	GWQC	MCL	MA-MW-10S-R2	MA-MW-11M-R1	MA-MW-11M-R2	MA-MW-11S-R2	MA-MW-12M-R1
Sample Date			09/19/2002	06/20/2002	09/23/2002	09/23/2002	06/18/2002
Sample Interval			8 - 18 ft	46 - 56 ft	46 - 56 ft	11 - 21 ft	38.1 - 48.1 ft
CLP Sample ID			B0QB2	B0KZ6	B0QB3	B0QB7	B0KY5
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5			0.3 J		
Dichloroethane-1,1	70		0.61	1.9	1.8		
Dichloroethane-1,2	2	5	0.23 J				
Dichloroethylene-1,2 cis	10	70	1.9	9.5	8.6	0.25 J	14 J (A)
Dichloropropane-1,2	1	5		1.6 (A)	1.7 (A)		
Tetrachloroethylene	1	5			0.15 J	0.29 J	
Trichlorobenzene-1,2,4	9	70					
Trichloroethane-1,1,1	30	200					
Trichloroethylene	1	5			0.45 J	1.2 (A)	
Vinyl chloride	5	2	2.6 (B)				3.3 J (B)
Xylenes, total	40	10000					

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-12M	MA-MW-12S	MA-MW-12S	MA-MW-13M	MA-MW-13M
Sample ID	GWQC	MCL	MA-MW-12M-R2	MA-MW-12S-R1	MA-MW-12S-R2	MA-MW-13M-R1	MA-MW-13M-R1-D
Sample Date			09/24/2002	06/18/2002	09/24/2002	06/27/2002	06/27/2002
Sample Interval			38.1 - 48.1 ft	5.4 - 15.4 ft	5.4 - 15.4 ft	48.35 - 58.35 ft	48.35 - 58.35 ft
CLP Sample ID			B0QB6	B0KX9	B0QB5	B0KY1	B0KX7
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5	0.32 J	2 J (A)	2.4 (A)		
Dichloroethane-1,1	70			7.2 J	9		
Dichloroethane-1,2	2	5					
Dichloroethylene-1,2 cis	10	70	14 (A)	180 J (AB)	180 (AB)	12 J (A)	14 J (A)
Dichloropropane-1,2	1	5					
Tetrachloroethylene	1	5			0.2 J		
Trichlorobenzene-1,2,4	9	70		3.1 J	2.2		
Trichloroethane-1,1,1	30	200		0.55 J			
Trichloroethylene	1	5		2.7 J (A)	5.5 (AB)		
Vinyl chloride	5	2	2.4 (B)	58 J (AB)	10 J (AB)		
Xylenes, total	40	10000		4.6 J			

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-13M	MA-MW-13M	MA-MW-13S	MA-MW-14R	MA-MW-14S
Sample ID	GWQC	MCL	MA-MW-13M-R2	MA-MW-13M-R2-D	MA-MW-13S-R1	MA-MW-14R-R2	MA-MW-14S-R1
Sample Date			09/25/2002	09/25/2002	06/28/2002	09/24/2002	06/18/2002
Sample Interval			48.35 - 58.35 ft	48.35 - 58.35 ft	6.6 - 16.6 ft	109.5 - 119.5 ft	7 - 20 ft
CLP Sample ID			B0QC0	B0QB0	B0KX8	B0QC3	B0KY4
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5	2.6 (A)	1.3 (A)	69 J (AB)	0.22 J	0.84
Dichloroethane-1,1	70		0.71	0.38 J	3.5 J	1.1	5.6
Dichloroethane-1,2	2	5				0.25 J	
Dichloroethylene-1,2 cis	10	70	8.7	1.1 (A)	12 J (A)	8.8	320 (AB)
Dichloropropane-1,2	1	5					
Tetrachloroethylene	1	5			0.55 J		
Trichlorobenzene-1,2,4	9	70			1.1 J (A)		1.9
Trichloroethane-1,1,1	30	200	0.25 J				
Trichloroethylene	1	5			1.1 J (A)	0.15 J	8.1 (AB)
Vinyl chloride	5	2	0.5	0.57		3.8 (B)	48 (AB)
Xylenes, total	40	10000		0.5	57 J (A)		

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-14S	MA-MW-14S	MA-MW-15M	MA-MW-15M	MA-MW-15S
Sample ID	GWQC	MCL	MA-MW-14S-R2	MA-MW-14S-R2-D	MA-MW-15M-R1	MA-MW-15M-R2	MA-MW-15S-R1
Sample Date			09/24/2002	09/24/2002	06/19/2002	09/23/2002	06/19/2002
Sample Interval			7 - 20 ft	7 - 20 ft	59.4 - 69.4 ft	59.4 - 69.4 ft	6.8 - 16.8 ft
CLP Sample ID			B0QC1	B0QA9	B0KY8	B0N57	B0KZ0
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5	1.1 (A)	1.3 (A)	0.53	0.77	9.2 J (AB)
Dichloroethane-1,1	70		7.8	8.6	1.1	1.4	3.9 J
Dichloroethane-1,2	2	5				0.46 J	1.5 J
Dichloroethylene-1,2 cis	10	70	330 (AB)	380 (AB)	40 (A)	37 (A)	9.7 J
Dichloropropane-1,2	1	5					
Tetrachloroethylene	1	5					
Trichlorobenzene-1,2,4	9	70	1.8	2			
Trichloroethane-1,1,1	30	200					
Trichloroethylene	1	5	1.1 (AB)	1.1 (AB)		0.56	1.4 J (A)
Vinyl chloride	5	2	17 J (AB)	5.1 J (AB)	16 (AB)	17 (AB)	3 J (B)
Xylenes, total	40	10000	1.2	1.2			0.77 J

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-15S	MA-MW-16S	MA-MW-16S	MA-MW-17M	MA-MW-17M
Sample ID	GWQC	MCL	MA-MW-15S-R2	MA-MW-16S-R1	MA-MW-16S-R2	MA-MW-17M-R1	MA-MW-17M-R2
Sample Date			09/25/2002	06/27/2002	09/25/2002	06/14/2002	09/18/2002
Sample Interval			6.8 - 16.8 ft	6.5 - 16.5 ft	6.5 - 16.5 ft	41.82 - 51.82 ft	41.82 - 51.82 ft
CLP Sample ID			B0QE1	B0L33	B0QD7	B0L34	B0QE0
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5	38 (AB)	22 J (AB)	31 (AB)		8.3 J (AB)
Dichloroethane-1,1	70		0.89	120 J (A)	41		
Dichloroethane-1,2	2	5			3.5 (A)		
Dichloroethylene-1,2 cis	10	70	1.6	12 J (A)	9.6	14 (A)	1.5
Dichloropropane-1,2	1	5					
Tetrachloroethylene	1	5		0.75 J	0.33 J		
Trichlorobenzene-1,2,4	9	70					
Trichloroethane-1,1,1	30	200		87 J (A)	18		
Trichloroethylene	1	5	0.17 J	1.8 J (A)	1.5 (A)		
Vinyl chloride	5	2	1.2	3.1 J (B)	5.7 (AB)	2.8 J (B)	0.55
Xylenes, total	40	10000	2.8	9 J	10		18

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
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Station ID	(A)	(B)	MA-MW-17S	MA-MW-19R	MA-MW-01M	MA-MW-01M	MA-MW-20D
Sample ID	GWQC	MCL	MA-MW-17S-R2	MA-MW-19R-R2	MA-MW-1M-R1	MA-MW-1M-R2	MA-MW-20D-R1
Sample Date			09/18/2002	09/19/2002	06/20/2002	09/23/2002	06/13/2002
Sample Interval			8 - 18 ft	103 - 113 ft	50 - 60 ft	50 - 60 ft	123 - 133 ft
CLP Sample ID			B0QD9	B0N56	B0KZ2	B0N59	B0L25
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5	2 J (A)	0.16 J	0.58 J	0.64 J	
Dichloroethane-1,1	70		0.15 J	0.33 J		0.17 J	2.6
Dichloroethane-1,2	2	5		0.21 J			
Dichloroethylene-1,2 cis	10	70	0.28 J	3.6	27 J (A)	22 (A)	18 (A)
Dichloropropane-1,2	1	5					
Tetrachloroethylene	1	5					
Trichlorobenzene-1,2,4	9	70					
Trichloroethane-1,1,1	30	200					
Trichloroethylene	1	5		0.46 J			1.5 (A)
Vinyl chloride	5	2		2.4 (B)	7.3 J (AB)	9.4 (AB)	9 (AB)
Xylenes, total	40	10000	1.1				

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
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Station ID	(A)	(B)	MA-MW-20D	MA-MW-20M	MA-MW-20R	MA-MW-20R	MA-MW-20S
Sample ID	GWQC	MCL	MA-MW-20D-R2	MA-MW-20M-R2	MA-MW-20R-R1	MA-MW-20R-R2	MA-MW-20S-R1
Sample Date			09/20/2002	09/20/2002	06/13/2002	09/20/2002	06/13/2002
Sample Interval			123 - 133 ft	42 - 52 ft	113 - 123 ft	113 - 123 ft	7.9 - 17.9 ft
CLP Sample ID			B0N63	B0N61	B0L26	B0N62	B0L22
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5	0.33 J	0.28 J		0.26 J	
Dichloroethane-1,1	70		1.9	1.3	2.4	2.3	1.1
Dichloroethane-1,2	2	5	0.87	0.37 J		0.53	
Dichloroethylene-1,2 cis	10	70	14 (A)	9.4	16 (A)	9.8	
Dichloropropane-1,2	1	5		0.25 J			
Tetrachloroethylene	1	5					
Trichlorobenzene-1,2,4	9	70					
Trichloroethane-1,1,1	30	200				22	50 (A)
Trichloroethylene	1	5	1 (A)	0.51	1.4 (A)	1.1 (A)	0.92
Vinyl chloride	5	2	8 (AB)	4.2 (B)	9.3 (AB)	6.1 (AB)	
Xylenes, total	40	10000					

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-20S	MA-MW-05S	MA-MW-05S	MA-MW-05S	MA-MW-09D
Sample ID	GWQC	MCL	MA-MW-20S-R2	MA-MW-5S-R1	MA-MW-5S-R1-D	MA-MW-5S-R2	MA-MW-9D-R1
Sample Date			09/20/2002	06/27/2002	06/27/2002	09/25/2002	06/19/2002
Sample Interval			7.9 - 17.9 ft	6 - 16 ft	6 - 16 ft	6 - 16 ft	44 - 54 ft
CLP Sample ID			B0N66	B0KZ7	B0KZ8	B0N64	B0KY6
Chemical Name							
Volatile Organic Compounds (ug/L)							
Benzene	1	5		150 J (AB)	150 J (AB)	110 (AB)	
Dichloroethane-1,1	70		4				0.68
Dichloroethane-1,2	2	5					
Dichloroethylene-1,2 cis	10	70	0.61	0.71 J	0.69 J		32 (A)
Dichloropropane-1,2	1	5					
Tetrachloroethylene	1	5					1 (A)
Trichlorobenzene-1,2,4	9	70					
Trichloroethane-1,1,1	30	200	60 (A)				
Trichloroethylene	1	5	1.6 (A)				0.94
Vinyl chloride	5	2					
Xylenes, total	40	10000		89 J (A)	90 J (A)	17	

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-9
Groundwater -Volatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-09D	MA-MW-09S	MA-MW-09S
Sample ID	GWQC	MCL	MA-MW-9D-R2	MA-MW-9S-R1	MA-MW-9S-R2
Sample Date			09/19/2002	06/19/2002	09/19/2002
Sample Interval			44 - 54 ft	16 - 26 ft	16 - 26 ft
CLP Sample ID			B0N65	B0KX6	B0N69
Chemical Name					
Volatile Organic Compounds (ug/L)					
Benzene	1	5	0.19 J		0.58
Dichloroethane-1,1	70		1.8	1.4 J	0.65 J
Dichloroethane-1,2	2	5			
Dichloroethylene-1,2 cis	10	70	6.6	4.4 J	23 (A)
Dichloropropane-1,2	1	5	0.74 J	1.2 J (A)	0.64
Tetrachloroethylene	1	5	0.78	0.86 J	1.5 (A)
Trichlorobenzene-1,2,4	9	70			
Trichloroethane-1,1,1	30	200			
Trichloroethylene	1	5	1.3 (A)	1.7 J (A)	1.7 (A)
Vinyl chloride	5	2	1		
Xylenes, total	40	10000			

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-10
Groundwater - Semivolatile Organic Compound Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-13S	MA-MW-01S	MA-MW-09S
Sample ID	GWQC	MCL	MA-MW-13S-R1	MA-MW-1S-R2	MA-MW-9S-R2
Sample Date			06/28/2002	09/23/2002	09/19/2002
Sample Interval			6.6 - 16.6 ft	4 - 14 ft	16 - 26 ft
CLP Sample ID			B0KX8	B0N58	B0N69
Chemical Name					
Semivolatile Organic Compounds (ug/L)					
Ether, bis(2-chloroethyl)	10				15 (A)
Nitrosodiphenylamine-n	20		70 J (A)	38 (A)	
Phenol	4000		7200 (A)		

J - Reported value estimated in quantity
(A, B, C) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-10S	MA-MW-10S	MA-MW-10S	MA-MW-10S	MA-MW-11M
Sample ID	GWQC	MCL	MA-MW-10S-R1	MA-MW-10S-R1	MA-MW-10S-R2	MA-MW-10S-R2	MA-MW-11M-R1
Sample Date			06/19/2002	06/19/2002	09/19/2002	09/19/2002	06/20/2002
Sample Interval			8 - 18 ft	8 - 18 ft	8 - 18 ft	8 - 18 ft	46 - 56 ft
CLP Sample ID			MB0KR8	MB0KW8	MB0NQ1-Dissolved	MB0NQ2	MB0KS1
Chemical Name							
Metals (ug/L)							
Aluminum	200					566 (A)	
Antimony	20	6					
Arsenic	8	10	480 (AB)	470 (AB)	462 J (AB)	523 J (AB)	
Barium	2000	2000	800	420	1100	1940	74
Beryllium	20	4					
Cadmium	4	5			11.1 (AB)	45.7 (AB)	
Chromium	100	100			3 B	5.5 B	
Iron	300		12000 (A)	12000 (A)	10000 (A)	12500 (A)	
Lead	10	15				35.5 J (AB)	
Manganese	50		700 (A)	690 (A)	616 (A)	642 (A)	2000 (A)
Metals (mg/l)							
Sodium	50		51 (A)	52 (A)	49900 (A)	52100 (A)	96 (A)
Metals (ug/L)							
Sodium	50000		51	52	49900	52100 (A)	96
Thallium	10	2			3.1 B (B)		

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-11M	MA-MW-11M	MA-MW-11M	MA-MW-11S	MA-MW-11S
Sample ID	GWQC	MCL	MA-MW-11M-R1	MA-MW-11M-R2	MA-MW-11M-R2	MA-MW-11S-R1	MA-MW-11S-R1
Sample Date			06/20/2002	09/23/2002	09/23/2002	06/20/2002	06/20/2002
Sample Interval			46 - 56 ft	46 - 56 ft	46 - 56 ft	11 - 21 ft	11 - 21 ft
CLP Sample ID			MB0KW9	MB0NQ4- Dissolved	MB0NQ6	MB0KS5	MB0KW6
Chemical Name							
Metals (ug/L)							
Aluminum	200			193 B	117 B	17000 (A)	
Antimony	20	6					
Arsenic	8	10				12 (AB)	
Barium	2000	2000	74	80.2 B	89.7 B	510	68
Beryllium	20	4					
Cadmium	4	5		4.1 B (A)	8.3 (AB)		4.3 (A)
Chromium	100	100			1.1 B	54	9.3
Iron	300			67.2 B	274	21000 (A)	
Lead	10	15			1.7 B	51 (AB)	
Manganese	50		1900 (A)	1950 (A)	2060 (A)	190 (A)	11
Sodium	50000		98	79800 (A)	81000 (A)	17	19
Metals (mg/l)							
Sodium	50		98 (A)	79800 (A)	81000 (A)	17	19
Metals (ug/L)							
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-11S	MA-MW-11S	MA-MW-12M	MA-MW-12M	MA-MW-12M
Sample ID	GWQC	MCL	MA-MW-11S-R2	MA-MW-11S-R2	MA-MW-12M-R1	MA-MW-12M-R1	MA-MW-12M-R2
Sample Date			09/23/2002	09/23/2002	06/18/2002	06/18/2002	09/24/2002
Sample Interval			11 - 21 ft	11 - 21 ft	38.1 - 48.1 ft	38.1 - 48.1 ft	38.1 - 48.1 ft
CLP Sample ID			MB0NQ5	MB0NQ9- Dissolved	MB0KR6	MB0KT6	MB0NQ7- Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200		1360 (A)		2300 (A)		
Antimony	20	6					2.2 B
Arsenic	8	10	5.4 BJ		21 (AB)	16 (AB)	21 (AB)
Barium	2000	2000	113 B	66.6 B	210	190	210
Beryllium	20	4					0.33 B
Cadmium	4	5	4.4 B (A)	4.4 B (A)			
Chromium	100	100	18.2	13.4			
Iron	300		1780 (A)		32000 (A)	29000 (A)	29900 (A)
Lead	10	15	5.5				
Manganese	50		23.1	11.8 B	420 (A)	450 (A)	442 (A)
Sodium	50000		17900	18000	46	51	49200
Metals (mg/l)							
Sodium	50		17900 (A)	18000 (A)	46	51 (A)	49200 (A)
Metals (ug/L)							
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-12M	MA-MW-12S	MA-MW-12S	MA-MW-12S	MA-MW-12S
Sample ID	GWQC	MCL	MA-MW-12M-R2	MA-MW-12S-R1	MA-MW-12S-R1	MA-MW-12S-R2	MA-MW-12S-R2
Sample Date			09/24/2002	06/18/2002	06/18/2002	09/24/2002	09/24/2002
Sample Interval			38.1 - 48.1 ft	5.4 - 15.4 ft	5.4 - 15.4 ft	5.4 - 15.4 ft	5.4 - 15.4 ft
CLP Sample ID			MB0NQ8	MB0KR3	MB0KT7	MB0NR0	MB0NR2- Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200		3980 (A)	1900 (A)		6870 (A)	
Antimony	20	6				1.9 BJ	
Arsenic	8	10	29.5 J (AB)	6.1 (AB)	50 (AB)	44.8 J (AB)	31.1 (AB)
Barium	2000	2000	337	55	40	113 B	63.9 B
Beryllium	20	4	1.5 B			0.58 B	0.23 B
Cadmium	4	5				0.25 B	
Chromium	100	100	17.3	9.8		32.1	3.6 B
Iron	300		57700 (A)	22000 (A)	21000 (A)	30700 (A)	21600 (A)
Lead	10	15	6.4			24 (AB)	
Manganese	50		590 (A)	550 (A)	560 (A)	528 (A)	461 (A)
Metals (mg/l)							
Sodium	50		51700 (A)	67 (A)	75 (A)	83200 (A)	80600 (A)
Metals (ug/L)							
Sodium	50000		51700 (A)	67	75	83200 (A)	80600 (A)
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-13M	MA-MW-13M	MA-MW-13M	MA-MW-13M	MA-MW-13M
Sample ID	GWQC	MCL	MA-MW-13M-R1	MA-MW-13M-R1	MA-MW-13M-R1-D	MA-MW-13M-R1-D	MA-MW-13M-R2
Sample Date			06/27/2002	06/27/2002	06/27/2002	06/27/2002	09/25/2002
Sample Interval			48.35 - 58.35 ft	48.35 - 58.35 ft	48.35 - 58.35 ft	48.35 - 58.35 ft	48.35 - 58.35 ft
CLP Sample ID			MB0KR0	MB0KT2	MB0KQ8	MB0KT3	MB0NR1- Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200		210 (A)				105 B
Antimony	20	6					2 B
Arsenic	8	10	130 (AB)	130 (AB)	130 (AB)	130 (AB)	125 (AB)
Barium	2000	2000	150	130	150	130	139 B
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100					
Iron	300		22000 (A)	21000 (A)	22000 (A)	21000 (A)	20400 (A)
Lead	10	15					
Manganese	50		760 (A)	740 (A)	760 (A)	740 (A)	696 (A)
Metals (mg/l)							
Sodium	50		79 (A)	77 (A)	80 (A)	79 (A)	69200 (A)
Metals (ug/L)							
Sodium	50000		79	77	80	79	69200 (A)
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-13M	MA-MW-13M	MA-MW-13M	MA-MW-13S	MA-MW-13S
Sample ID	GWQC	MCL	MA-MW-13M-R2	MA-MW-13M-R2-D	MA-MW-13M-R2-D	MA-MW-13S-R1	MA-MW-13S-R1
Sample Date			09/25/2002	09/25/2002	09/25/2002	06/28/2002	06/28/2002
Sample Interval			48.35 - 58.35 ft	48.35 - 58.35 ft	48.35 - 58.35 ft	6.6 - 16.6 ft	6.6 - 16.6 ft
CLP Sample ID			MB0NR5	MB0NP5- Dissolved	MB0NP6	MB0KR2	MB0KT4
Chemical Name							
Metals (ug/L)							
Aluminum	200		1810 (A)	67.5 B	1600 (A)	400 (A)	
Antimony	20	6					
Arsenic	8	10	143 J (AB)	124 (AB)	138 J (AB)	6400 (AB)	2000 (AB)
Barium	2000	2000	277	141 B	220	26000 (AB)	1000
Beryllium	20	4	1.4 B	0.26 B	1.2 B		
Cadmium	4	5	0.92 B		0.7 B		
Chromium	100	100	18.5		14.6	18	9.1
Iron	300		45400 (A)	20800 (A)	44200 (A)	70000 (A)	990 (A)
Lead	10	15	2.2 B		1.8 B		
Manganese	50		743 (A)	706 (A)	734 (A)	200 (A)	53 (A)
Metals (mg/l)							
Sodium	50		70500 (A)	69700 (A)	70400 (A)	88 (A)	110 (A)
Metals (ug/L)							
Sodium	50000		70500 (A)	69700 (A)	70400 (A)	88	110
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-13S	MA-MW-13S	MA-MW-14D	MA-MW-14D	MA-MW-14D
Sample ID	GWQC	MCL	MA-MW-13S-R2	MA-MW-13S-R2	MA-MW-14D-R1	MA-MW-14D-R1	MA-MW-14D-R2
Sample Date			09/25/2002	09/25/2002	06/18/2002	06/18/2002	09/24/2002
Sample Interval			6.6 - 16.6 ft	6.6 - 16.6 ft	170 - 188 ft	170 - 188 ft	170 - 188 ft
CLP Sample ID			MB0NR3- Dissolved	MB0NR4	MB0KQ6	MB0KS9	MB0NR7
Chemical Name							
Metals (ug/L)							
Aluminum	200		110 B	206 (A)	650 (A)		772 (A)
Antimony	20	6	23.7 B (AB)	6.4 BJ (B)			
Arsenic	8	10					2.4 BJ
Barium	2000	2000	3560 (AB)	36500 (AB)	34	28	38.3 B
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100	9 B	35.8			4.1 B
Iron	300		235	11700 (A)	2600 (A)	2100 (A)	3660 (A)
Lead	10	15		3.9			2.6 B
Manganese	50		11 B	139 (A)	190 (A)	190 (A)	214 (A)
Metals (mg/l)							
Sodium	50		184000 J (A)	145000 J (A)	15	16	15400 (A)
Metals (ug/L)							
Sodium	50000		184000 J (A)	145000 J (A)	15	16	15400
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-14D	MA-MW-14R	MA-MW-14R	MA-MW-14R	MA-MW-14R
Sample ID	GWQC	MCL	MA-MW-14D-R2	MA-MW-14R-R1	MA-MW-14R-R1	MA-MW-14R-R2	MA-MW-14R-R2
Sample Date			09/24/2002	06/18/2002	06/18/2002	09/24/2002	09/24/2002
Sample Interval			170 - 188 ft	109.5 - 119.5 ft	109.5 - 119.5 ft	109.5 - 119.5 ft	109.5 - 119.5 ft
CLP Sample ID			MB0NR8- Dissolved	MB0KQ9	MB0KT1	MB0NR6- Dissolved	MB0NS1
Chemical Name							
Metals (ug/L)							
Aluminum	200			210 (A)			503 (A)
Antimony	20	6					
Arsenic	8	10				1.9 B	5 BJ
Barium	2000	2000	32.4 B	55	54	60.2 B	70.1 B
Beryllium	20	4	0.27 B				
Cadmium	4	5					
Chromium	100	100					3.2 B
Iron	300		2320 (A)	11000 (A)	11000 (A)	13100 (A)	14600 (A)
Lead	10	15					1.8 B
Manganese	50		198 (A)	1800 (A)	1900 (A)	2130 (A)	2290 (A)
Metals (mg/l)							
Sodium	50		15600 (A)	76 (A)	79 (A)	76100 (A)	78900 (A)
Metals (ug/L)							
Sodium	50000		15600	76	79	76100 (A)	78900 (A)
Thallium	10	2				2.6 B (B)	2.7 B (B)

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
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Station ID	(A)	(B)	MA-MW-14S	MA-MW-14S	MA-MW-14S	MA-MW-14S	MA-MW-14S
Sample ID	GWQC	MCL	MA-MW-14S-R1	MA-MW-14S-R1	MA-MW-14S-R2	MA-MW-14S-R2	MA-MW-14S-R2-D
Sample Date			06/18/2002	06/18/2002	09/24/2002	09/24/2002	09/24/2002
Sample Interval			7 - 20 ft	7 - 20 ft	7 - 20 ft	7 - 20 ft	7 - 20 ft
CLP Sample ID			MB0KQ7	MB0M60	MB0NR9- Dissolved	MB0NS0	MB0NP8
Chemical Name							
Metals (ug/L)							
Aluminum	200		250 (A)			97.6 B	109 B
Antimony	20	6			4 B		
Arsenic	8	10	31 (AB)	27 (AB)	45.2 J (AB)	42.1 J (AB)	42.6 J (AB)
Barium	2000	2000	37	38	50 B	48.7 B	51 B
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100			2.4 B	3.3 B	3.2 B
Iron	300		1200 (A)	1100 (A)	933 J (A)	923 (A)	953 (A)
Lead	10	15					
Manganese	50		240 (A)	260 (A)	269 J (A)	274 (A)	287 (A)
Metals (mg/l)							
Sodium	50		66 (A)	72 (A)	70900 (A)	71100 (A)	74100 (A)
Metals (ug/L)							
Sodium	50000		66	72	70900 (A)	71100 (A)	74100 (A)
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-14S	MA-MW-15M	MA-MW-15M	MA-MW-15M	MA-MW-15S
Sample ID	GWQC	MCL	MA-MW-14S-R2-D	MA-MW-15M-R1	MA-MW-15M-R2	MA-MW-15M-R2	MA-MW-15S-R1
Sample Date			09/24/2002	06/19/2002	09/23/2002	09/23/2002	06/19/2002
Sample Interval			7 - 20 ft	59.4 - 69.4 ft	59.4 - 69.4 ft	59.4 - 69.4 ft	6.8 - 16.8 ft
CLP Sample ID			MB0NQ0- Dissolved	MB0M61	MB0M97- Dissolved	MB0M98	MB0KR9
Chemical Name							
Metals (ug/L)							
Aluminum	200					14800 (A)	2700 (A)
Antimony	20	6	1.9 B		2.9 B	7 B (B)	
Arsenic	8	10	24.7 J (AB)		1.5 B	15.8 J (AB)	
Barium	2000	2000	27.1 B	100	113 B	175 B	95
Beryllium	20	4			0.22 B	12.8 (B)	
Cadmium	4	5					
Chromium	100	100	1.3 B			72.6	15
Iron	300		479 J (A)	28000 (A)	27000 (A)	250000 (A)	57000 (A)
Lead	10	15					
Manganese	50		153 J (A)	1900 (A)	1740 (A)	2020 (A)	1700 (A)
Sodium	50000		42800	68	63800 (A)	61400 (A)	58
Metals (mg/l)							
Sodium	50		42800 (A)	68 (A)	63800 (A)	61400 (A)	58 (A)
Metals (ug/L)							
Thallium	10	2				12.8 (AB)	

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-15S	MA-MW-15S	MA-MW-15S	MA-MW-16S	MA-MW-16S
Sample ID	GWQC	MCL	MA-MW-15S-R1	MA-MW-15S-R2	MA-MW-15S-R2	MA-MW-16S-R1	MA-MW-16S-R1
Sample Date			06/19/2002	09/25/2002	09/25/2002	06/27/2002	06/27/2002
Sample Interval			6.8 - 16.8 ft	6.8 - 16.8 ft	6.8 - 16.8 ft	6.5 - 16.5 ft	6.5 - 16.5 ft
CLP Sample ID			MB0M62	MB0M82	MB0M83- Dissolved	MB0KY3	MB0M63
Chemical Name							
Metals (ug/L)							
Aluminum	200			2580 (A)		570 (A)	
Antimony	20	6		3.7 BJ			
Arsenic	8	10	1200 (AB)	1770 J (AB)	857 (AB)	2200 (AB)	2100 (AB)
Barium	2000	2000	510	852	650	250	210
Beryllium	20	4					
Cadmium	4	5		2.6 B			
Chromium	100	100	10	55.5	13.4	34	6
Iron	300		12000 (A)	23200 (A)	9320 (A)	18000 (A)	20000 (A)
Lead	10	15		192 (AB)			
Manganese	50		440 (A)	565 (A)	549 (A)	570 (A)	560 (A)
Metals (mg/l)							
Sodium	50		74 (A)	105000 (A)	75500 (A)	110 (A)	92 (A)
Metals (ug/L)							
Sodium	50000		74	105000 (A)	75500 (A)	110	92
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-16S	MA-MW-16S	MA-MW-17M	MA-MW-17M	MA-MW-17M
Sample ID	GWQC	MCL	MA-MW-16S-R2	MA-MW-16S-R2	MA-MW-17M-R1	MA-MW-17M-R1	MA-MW-17M-R2
Sample Date			09/25/2002	09/25/2002	06/14/2002	06/14/2002	09/18/2002
Sample Interval			6.5 - 16.5 ft	6.5 - 16.5 ft	41.82 - 51.82 ft	41.82 - 51.82 ft	41.82 - 51.82 ft
CLP Sample ID			MB0M84- Dissolved	MB0M86	MB0KY2	MB0M64	MB0M85
Chemical Name							
Metals (ug/L)							
Aluminum	200			584 (A)	4700 (A)		6090 (A)
Antimony	20	6					
Arsenic	8	10	2060 (AB)	1980 J (AB)			14.6 J (AB)
Barium	2000	2000	425	528	99	62	191 B
Beryllium	20	4					3.6 B
Cadmium	4	5		0.22 B			
Chromium	100	100	11.8	69.1	19		28.7
Iron	300		4090 (A)	8740 (A)	45000 (A)	2400 (A)	71000 (A)
Lead	10	15		7.4			8.9 J
Manganese	50		346 (A)	370 (A)	720 (A)	740 (A)	725 (A)
Sodium	50000		98100 (A)	100000 (A)	56	65	58800 (A)
Metals (mg/l)							
Sodium	50		98100 (A)	100000 (A)	56 (A)	65 (A)	58800 (A)
Metals (ug/L)							
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-17M	MA-MW-17S	MA-MW-17S	MA-MW-17S	MA-MW-17S
Sample ID	GWQC	MCL	MA-MW-17M-R2	MA-MW-17S-R1	MA-MW-17S-R1	MA-MW-17S-R2	MA-MW-17S-R2
Sample Date			09/18/2002	06/14/2002	06/14/2002	09/18/2002	09/18/2002
Sample Interval			41.82 - 51.82 ft	8 - 18 ft	8 - 18 ft	8 - 18 ft	8 - 18 ft
CLP Sample ID			MB0M89-Dissolved	MB0KY4	MB0M65	MB0M87	MB0M88-Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200						
Antimony	20	6	1.7 B			1.8 B	
Arsenic	8	10	2.6 B	290 (AB)	290 (AB)	541 J (AB)	564 J (AB)
Barium	2000	2000	65.4 B	110	120	136 B	142 B
Beryllium	20	4					
Cadmium	4	5		14 (AB)	14 (AB)	12.2 (AB)	12.7 (AB)
Chromium	100	100				1.3 B	2.2 B
Iron	300		2610 (A)	300 (A)	470 (A)	3030 (A)	3330 (A)
Lead	10	15					
Manganese	50		650 (A)	96 (A)	110 (A)	120 (A)	132 (A)
Metals (mg/l)							
Sodium	50		60400 (A)	21	21	24800 (A)	25300 (A)
Metals (ug/L)							
Sodium	50000		60400 (A)	21	21	24800	25300
Thallium	10	2	2.7 B (B)				

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-18D	MA-MW-18D	MA-MW-18D	MA-MW-18D	MA-MW-18M
Sample ID	GWQC	MCL	MA-MW-18D-R1	MA-MW-18D-R1	MA-MW-18D-R2	MA-MW-18D-R2	MA-MW-18M-R1
Sample Date			06/17/2002	06/17/2002	09/18/2002	09/18/2002	06/17/2002
Sample Interval			140 - 152 ft	140 - 152 ft	140 - 152 ft	140 - 152 ft	31.77 - 41.77 ft
CLP Sample ID			MB0KX9	MB0M66	MB0M90	MB0M95-Dissolved	MB0KY0
Chemical Name							
Metals (ug/L)							
Aluminum	200		320 (A)		3670 (A)		
Antimony	20	6					
Arsenic	8	10			3.5 B		58 (AB)
Barium	2000	2000	47	43	93.5 B	48.7 B	80
Beryllium	20	4			0.66 B		
Cadmium	4	5					
Chromium	100	100			10.6	0.88 B	
Iron	300		430 (A)	250	8300 (A)	284	16000 (A)
Lead	10	15			16.6 J (AB)		
Manganese	50		360 (A)	350 (A)	598 (A)	415 (A)	170 (A)
Metals (mg/l)							
Sodium	50		27	27	26400 (A)	21600 (A)	26
Metals (ug/L)							
Sodium	50000		27	27	26400	21600	26
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-18M	MA-MW-18M	MA-MW-18M	MA-MW-18S	MA-MW-18S
Sample ID	GWQC	MCL	MA-MW-18M-R1	MA-MW-18M-R2	MA-MW-18M-R2	MA-MW-18S-R1	MA-MW-18S-R1
Sample Date			06/17/2002	09/18/2002	09/18/2002	06/17/2002	06/17/2002
Sample Interval			31.77 - 41.77 ft	31.77 - 41.77 ft	31.77 - 41.77 ft	7.8 - 17.8 ft	7.8 - 17.8 ft
CLP Sample ID			MB0M67	MB0M91-Dissolved	MB0M92	MB0KY1	MB0M68
Chemical Name							
Metals (ug/L)							
Aluminum	200				268 (A)	350 (A)	
Antimony	20	6					
Arsenic	8	10	94 (AB)	98.9 J (AB)	94.8 J (AB)	9.2 (A)	
Barium	2000	2000	130	154 B	187 B	5400 (AB)	5200 (AB)
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100			1.4 B		
Iron	300		27000 (A)	26900 (A)	27100 (A)	28000 (A)	28000 (A)
Lead	10	15			1.5 B		
Manganese	50		280 (A)	278 (A)	313 (A)	1600 (A)	1600 (A)
Metals (mg/l)							
Sodium	50		45	41900 (A)	41900 (A)	39	40
Metals (ug/L)							
Sodium	50000		45	41900	41900	39	40
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
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Station ID	(A)	(B)	MA-MW-18S	MA-MW-18S	MA-MW-19M	MA-MW-19M	MA-MW-19M
Sample ID	GWQC	MCL	MA-MW-18S-R2	MA-MW-18S-R2	MA-MW-19M-R1	MA-MW-19M-R1	MA-MW-19M-R2
Sample Date			09/18/2002	09/18/2002	06/17/2002	06/17/2002	09/19/2002
Sample Interval			7.8 - 17.8 ft	7.8 - 17.8 ft	42 - 52 ft	42 - 52 ft	42 - 52 ft
CLP Sample ID			MB0M93	MB0M94-Dissolved	MB0KX7	MB0M69	MB0M96
Chemical Name							
Metals (ug/L)							
Aluminum	200		719 (A)		1300 (A)		909 (A)
Antimony	20	6					
Arsenic	8	10	12.8 (AB)	10.6 (AB)			3.3 B
Barium	2000	2000	6310 (AB)	5740 (AB)	82	76	98.2 B
Beryllium	20	4					0.23 B
Cadmium	4	5					
Chromium	100	100	3.8 B	3.1 B			4.7 B
Iron	300		26800 (A)	25400 (A)	7800 (A)	7500 (A)	9540 (A)
Lead	10	15	13.2 J (A)				2.6 B
Manganese	50		1350 (A)	1350 (A)	560 (A)	590 (A)	594 (A)
Metals (mg/l)							
Sodium	50		27000 (A)	27800 (A)	44	47	40100 (A)
Metals (ug/L)							
Sodium	50000		27000	27800	44	47	40100
Thallium	10	2		5.3 B (B)			

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
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Station ID	(A)	(B)	MA-MW-19M	MA-MW-19R	MA-MW-19R	MA-MW-19R	MA-MW-19R
Sample ID	GWQC	MCL	MA-MW-19M-R2	MA-MW-19R-R1	MA-MW-19R-R1	MA-MW-19R-R2	MA-MW-19R-R2
Sample Date			09/19/2002	06/17/2002	06/17/2002	09/19/2002	09/19/2002
Sample Interval			42 - 52 ft	103 - 113 ft	103 - 113 ft	103 - 113 ft	103 - 113 ft
CLP Sample ID			MB0MA1-Dissolved	MB0KX6	MB0M70	MB0M99	MB0MA0-Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200			1500 (A)	260 (A)	453 (A)	206 (A)
Antimony	20	6				2 B	1.6 B
Arsenic	8	10	2.2 B			1.6 B	
Barium	2000	2000	77.5 B	140	130	141 B	139 B
Beryllium	20	4				0.46 B	0.42 B
Cadmium	4	5				0.79 B	1.1 B
Chromium	100	100		15		3.5 B	
Iron	300		7550 (A)	94000 (A)	96000 (A)	80200 (A)	80500 (A)
Lead	10	15				3.3	
Manganese	50		589 (A)	5000 (A)	5200 (A)	4490 (A)	4540 (A)
Metals (mg/l)							
Sodium	50		40600 (A)	3500 (A)	3700 (A)	3010000 (A)	3060000 (A)
Metals (ug/L)							
Sodium	50000		40600	3500	3700	3010000 (A)	3060000 (A)
Thallium	10	2	3.6 B (B)			12.5 (AB)	12.9 (AB)

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
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Station ID	(A)	(B)	MA-MW-19S	MA-MW-19S	MA-MW-19S	MA-MW-19S	MA-MW-01M
Sample ID	GWQC	MCL	MA-MW-19S-R1	MA-MW-19S-R1	MA-MW-19S-R2	MA-MW-19S-R2	MA-MW-1M-R1
Sample Date			06/17/2002	06/17/2002	09/19/2002	09/19/2002	06/20/2002
Sample Interval			5.05 - 15.05 ft	5.05 - 15.05 ft	5.05 - 15.05 ft	5.05 - 15.05 ft	50 - 60 ft
CLP Sample ID			MB0KX8	MB0M71	MB0MA3-Dissolved	MB0MA4	MB0KS2
Chemical Name							
Metals (ug/L)							
Aluminum	200		430 (A)			131 B	
Antimony	20	6					
Arsenic	8	10					26 (AB)
Barium	2000	2000	1000	1000	1140	1230	130
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100			1.4 B	2.4 B	
Iron	300		5000 (A)	4600 (A)	3590 (A)	3840 (A)	16000 (A)
Lead	10	15				6.2	
Manganese	50		610 (A)	610 (A)	520 (A)	565 (A)	510 (A)
Metals (mg/l)							
Sodium	50		48	50 (A)	42100 (A)	47700 (A)	73 (A)
Metals (ug/L)							
Sodium	50000		48	50	42100	47700	73
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

05/20/2004

Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-01M	MA-MW-01M	MA-MW-01M	MA-MW-01S	MA-MW-01S
Sample ID	GWQC	MCL	MA-MW-1M-R1	MA-MW-1M-R2	MA-MW-1M-R2	MA-MW-1S-R1	MA-MW-1S-R1
Sample Date			06/20/2002	09/23/2002	09/23/2002	06/20/2002	06/20/2002
Sample Interval			50 - 60 ft	50 - 60 ft	50 - 60 ft	4 - 14 ft	4 - 14 ft
CLP Sample ID			MB0KW4	MB0MA2	MB0MA7-Dissolved	MB0KS4	MB0KW5
Chemical Name							
Metals (ug/L)							
Aluminum	200			72.8 B		240 (A)	
Antimony	20	6				19 (B)	
Arsenic	8	10	20 (AB)	24.5 J (AB)	20.2 (AB)	3600 (AB)	4700 (AB)
Barium	2000	2000	92	135 B	92.4 B	690	310
Beryllium	20	4					
Cadmium	4	5		3.3 B			
Chromium	100	100		1.4 B		8.6	
Iron	300		16000 (A)	17800 (A)	15600 (A)	2200 (A)	4600 (A)
Lead	10	15		0.72 B			
Manganese	50		470 (A)	502 (A)	465 (A)	71 (A)	270 (A)
Sodium	50000		76	72900 (A)	67100 (A)	98	68
Metals (mg/l)							
Sodium	50		76 (A)	72900 (A)	67100 (A)	98 (A)	68 (A)
Metals (ug/L)							
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-01S	MA-MW-01S	MA-MW-20D	MA-MW-20D	MA-MW-20D
Sample ID	GWQC	MCL	MA-MW-1S-R2	MA-MW-1S-R2	MA-MW-20D-R1	MA-MW-20D-R1	MA-MW-20D-R2
Sample Date			09/23/2002	09/23/2002	06/13/2002	06/13/2002	09/20/2002
Sample Interval			4 - 14 ft	4 - 14 ft	123 - 133 ft	123 - 133 ft	123 - 133 ft
CLP Sample ID			MB0MA5	MB0MA6- Dissolved	MB0KX3	MB0M72	MB0MA8-Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200				980 (A)	970 (A)	162 B
Antimony	20	6	18.7 BJ (B)	2.9 B			3.4 B
Arsenic	8	10	7.130 J (AB)	3700 (AB)			
Barium	2000	2000	689 J	846 J	290	300	285
Beryllium	20	4			6.9 (B)	7.2 (B)	2.3 B
Cadmium	4	5					
Chromium	100	100	6.8 B	5.7 B			
Iron	300		2200 (A)	1320 (A)	170000 (A)	180000 (A)	153000 (A)
Lead	10	15					
Manganese	50		79.9 (A)	66.7 (A)	3900 (A)	4000 (A)	3280 (A)
Metals (mg/l)							
Sodium	50		61500 J (A)	74300 J (A)	940 (A)	980 (A)	690000 (A)
Metals (ug/L)							
Sodium	50000		61500 J (A)	74300 J (A)	940	980	690000 (A)
Thallium	10	2					15 J (AB)

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-20D	MA-MW-20M	MA-MW-20M	MA-MW-20M	MA-MW-20M
Sample ID	GWQC	MCL	MA-MW-20D-R2	MA-MW-20M-R1	MA-MW-20M-R1	MA-MW-20M-R2	MA-MW-20M-R2
Sample Date			09/20/2002	06/13/2002	06/13/2002	09/20/2002	09/20/2002
Sample Interval			123 - 133 ft	42 - 52 ft	42 - 52 ft	42 - 52 ft	42 - 52 ft
CLP Sample ID			MB0MB0	MB0KX4	MB0M73	MB0MA9	MB0MB3-Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200		181 B	1200 (A)	1900 (A)	1110 (A)	
Antimony	20	6	2.9 B				
Arsenic	8	10				3.8 B	
Barium	2000	2000	294	150	150	165 B	147 B
Beryllium	20	4	1.5 B			0.37 B	
Cadmium	4	5				0.8 B	0.57 B
Chromium	100	100	2.1 B			8.3 B	
Iron	300		161000 (A)	23000 (A)	23000 (A)	28000 (A)	22700 (A)
Lead	10	15				1.6 B	
Manganese	50		3440 (A)	1200 (A)	1200 (A)	1140 (A)	1110 (A)
Metals (mg/l)							
Sodium	50		690000 (A)	59 (A)	64 (A)	60900 (A)	61300 (A)
Metals (ug/L)							
Sodium	50000		690000 (A)	59	64	60900 (A)	61300 (A)
Thallium	10	2	1215 J (AB)				313 B (B)

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-20R	MA-MW-20R	MA-MW-20R	MA-MW-20R	MA-MW-20S
Sample ID	GWQC	MCL	MA-MW-20R-R1	MA-MW-20R-R1	MA-MW-20R-R2	MA-MW-20R-R2	MA-MW-20S-R1
Sample Date			06/13/2002	06/13/2002	09/20/2002	09/20/2002	06/13/2002
Sample Interval			113 - 123 ft	113 - 123 ft	113 - 123 ft	113 - 123 ft	7.9 - 17.9 ft
CLP Sample ID			MB0KX5	MB0M74	MB0MB1-Dissolved	MB0MB2	MB0KX1
Chemical Name							
Metals (ug/L)							
Aluminum	200		620 (A)	590 (A)	531 (A)	1080 (A)	4000 (A)
Antimony	20	6			2.2 B	2.9 B	
Arsenic	8	10					
Barium	2000	2000	260	260	240	239	93
Beryllium	20	4			5 B (B)	1.6 B	
Cadmium	4	5				0.21 B	
Chromium	100	100				3.2 B	10
Iron	300		140000 (A)	140000 (A)	133000 J (A)	106000 J (A)	5400 (A)
Lead	10	15				3.4	
Manganese	50		3200 (A)	3300 (A)	2960 J (A)	2470 J (A)	51 (A)
Metals (mg/l)							
Sodium	50		670 (A)	690 (A)	632000 J (A)	456000 J (A)	48
Metals (ug/L)							
Sodium	50000		670	690	632000 J (A)	456000 J (A)	48
Thallium	10	2			8.8 B (B)	7.8 B (B)	

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

05/20/2004

Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-20S	MA-MW-20S	MA-MW-21S	MA-MW-21S	MA-MW-21S
Sample ID	GWQC	MCL	MA-MW-20S-R2	MA-MW-20S-R2	MA-MW-21S-R1	MA-MW-21S-R1	MA-MW-21S-R2
Sample Date			09/20/2002	09/20/2002	06/12/2002	06/12/2002	09/17/2002
Sample Interval			7.9 - 17.9 ft	7.9 - 17.9 ft	10 - 21 ft	10 - 21 ft	10 - 21 ft
CLP Sample ID			MB0MB4-Dissolved	MB0MB6	MB0KX0	MB0M76	MB0L24
Chemical Name							
Metals (ug/L)							
Aluminum	200			33300 (A)	240 (A)		11400 (A)
Antimony	20	6		1.7 B			2.2 B
Arsenic	8	10		20.9 J (AB)	20 (AB)	17 (AB)	41.6 J (AB)
Barium	2000	2000	82.5 B	263	150	150	212
Beryllium	20	4		2.6 B			1 B
Cadmium	4	5					
Chromium	100	100	1.3 B	84			43.5
Iron	300		25.5 B	51900 (A)	700 (A)	540 (A)	16200 (A)
Lead	10	15		38.8 J (AB)			14.6 J (A)
Manganese	50		17	364 (A)	390 (A)	400 (A)	483 (A)
Metals (mg/l)							
Sodium	50		50100 (A)	53700 (A)	77 (A)	81 (A)	68900 (A)
Metals (ug/L)							
Sodium	50000		50100 (A)	53700 (A)	77	81	68900 (A)
Thallium	10	2	2.9 B (B)				

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-21S	MA-MW-22S	MA-MW-22S	MA-MW-22S	MA-MW-22S
Sample ID	GWQC	MCL	MA-MW-21S-R2	MA-MW-22S-R1	MA-MW-22S-R1	MA-MW-22S-R2	MA-MW-22S-R2
Sample Date			09/17/2002	06/12/2002	06/12/2002	09/17/2002	09/17/2002
Sample Interval			10 - 21 ft	10 - 21 ft	10 - 21 ft	10 - 21 ft	10 - 21 ft
CLP Sample ID			MB0L29-Dissolved	MB0KX2	MB0M77	MB0L27	MB0L28-Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200			36000 (A)		933 (A)	
Antimony	20	6	1.6 B				
Arsenic	8	10	31.9 J (AB)	27 (AB)			
Barium	2000	2000	148 B	480	75	94.9 B	94.7 B
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100	1.8 B	110 (AB)		4 B	1.7 B
Iron	300		1300 (A)	57000 (A)		1400 (A)	406 (A)
Lead	10	15		630 (AB)		11.2 J (A)	2.4 B
Manganese	50		423 (A)	890 (A)	230 (A)	218 (A)	196 (A)
Metals (mg/l)							
Sodium	50		69100 (A)	37	42	52200 (A)	47100 (A)
Metals (ug/L)							
Sodium	50000		69100 (A)	37	42	52200 (A)	47100
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-04S	MA-MW-04S	MA-MW-04S	MA-MW-04S	MA-MW-05S
Sample ID	GWQC	MCL	MA-MW-4S-R1	MA-MW-4S-R1	MA-MW-4S-R2	MA-MW-4S-R2	MA-MW-5S-R1
Sample Date			06/12/2002	06/12/2002	09/17/2002	09/17/2002	06/27/2002
Sample Interval			4 - 14 ft	4 - 14 ft	4 - 14 ft	4 - 14 ft	6 - 16 ft
CLP Sample ID			MB0KS3	MB0KW1	MB0L30-Dissolved	MB0L32	MB0KS8
Chemical Name							
Metals (ug/L)							
Aluminum	200					115 B	210 (A)
Antimony	20	6					
Arsenic	8	10	9.6 (A)		10.3 (AB)	12.6 (AB)	1200 (AB)
Barium	2000	2000	260	250	228	235	460
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100			2.8 B	3.2 B	21
Iron	300		12000 (A)	12000 (A)	7230 (A)	8950 (A)	4800 (A)
Lead	10	15				1.7 B	
Manganese	50		170 (A)	170 (A)	133 (A)	151 (A)	32
Metals (mg/l)							
Sodium	50		4.5	4.9	7470 (A)	7610 (A)	150 (A)
Metals (ug/L)							
Sodium	50000		4.5	4.9	7470	7610	150
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

05/20/2004

Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-05S	MA-MW-05S	MA-MW-05S	MA-MW-05S	MA-MW-05S
Sample ID	GWQC	MCL	MA-MW-5S-R1	MA-MW-5S-R1-D	MA-MW-5S-R1-D	MA-MW-5S-R2	MA-MW-5S-R2
Sample Date			06/27/2002	06/27/2002	06/27/2002	09/25/2002	09/25/2002
Sample Interval			6 - 16 ft	6 - 16 ft	6 - 16 ft	6 - 16 ft	6 - 16 ft
CLP Sample ID			MB0KW2	MB0KS6	MB0KT8	MB0MB5	MB0MB9- Dissolved
Chemical Name							
Metals (ug/L)							
Aluminum	200			200 (A)			82.8 B
Antimony	20	6				2.5 BJ	4.6 B
Arsenic	8	10	1000 (AB)	1200 (AB)	1100 (AB)	943 J (AB)	938 (AB)
Barium	2000	2000	490	470	550	212	215
Beryllium	20	4					0.36 B
Cadmium	4	5					
Chromium	100	100	18	21	18	19.7	19.4
Iron	300		1600 (A)	5400 (A)	1900 (A)	532 (A)	287
Lead	10	15					
Manganese	50		37	33	41	6.7 B	6.7 B
Metals (mg/l)							
Sodium	50		140 (A)	150 (A)	160 (A)	167000 (A)	169000 (A)
Metals (ug/L)							
Sodium	50000		140	150	160	167000 (A)	169000 (A)
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-08S	MA-MW-08S	MA-MW-08S	MA-MW-08S	MA-MW-09D
Sample ID	GWQC	MCL	MA-MW-8S-R1	MA-MW-8S-R1	MA-MW-8S-R2	MA-MW-8S-R2	MA-MW-9D-R1
Sample Date			06/12/2002	06/12/2002	09/17/2002	09/17/2002	06/19/2002
Sample Interval			4 - 14 ft	4 - 14 ft	4 - 14 ft	4 - 14 ft	44 - 54 ft
CLP Sample ID			MB0KR4	MB0KW0	MB0L31-Dissolved	MB0L35	MB0KR5
Chemical Name							
Metals (ug/L)							
Aluminum	200		580 (A)			144 B	
Antimony	20	6					
Arsenic	8	10			5.8 B	6.1 B	
Barium	2000	2000	310	340	431	409	79
Beryllium	20	4					
Cadmium	4	5					
Chromium	100	100	8.2	6.7	8.2 B	7.6 B	
Iron	300		9300 (A)	13000 (A)	17400 (A)	17300 (A)	12000 (A)
Lead	10	15				3.7	
Manganese	50		700 (A)	790 (A)	759 J (A)	653 J (A)	1500 (A)
Metals (mg/l)							
Sodium	50		19	20	25300 (A)	29800 (A)	56 (A)
Metals (ug/L)							
Sodium	50000		19	20	25300	29800	56
Thallium	10	2					

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-09D	MA-MW-09D	MA-MW-09D	MA-MW-09S	MA-MW-09S
Sample ID	GWQC	MCL	MA-MW-9D-R1	MA-MW-9D-R2	MA-MW-9D-R2	MA-MW-9S-R1	MA-MW-9S-R1
Sample Date			06/19/2002	09/19/2002	09/19/2002	06/19/2002	06/19/2002
Sample Interval			44 - 54 ft	44 - 54 ft	44 - 54 ft	16 - 26 ft	16 - 26 ft
CLP Sample ID			MB0KW3	MB0MB7	MB0MB8-Dissolved	MB0KR1	MB0KT5
Chemical Name							
Metals (ug/L)							
Aluminum	200			137 B		670 J (A)	
Antimony	20	6		2.5 B			
Arsenic	8	10					
Barium	2000	2000	79	76 B	69.3 B	150	110
Beryllium	20	4					
Cadmium	4	5		2.7 B	0.95 B		
Chromium	100	100		1.4 B	0.64 B		
Iron	300		11000 (A)	10100 (A)	10200 (A)	1200 (A)	
Lead	10	15		7.5 J			
Manganese	50		1500 (A)	1610 (A)	1470 (A)	400 (A)	380 (A)
Metals (mg/l)							
Sodium	50		58 (A)	53500 (A)	50400 (A)	80 (A)	81 (A)
Metals (ug/L)							
Sodium	50000		58	53500 (A)	50400 (A)	80	81
Thallium	10	2		2.8 B (B)	4.7 B (B)		

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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Table 5-11
Groundwater - Metals Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-09S	MA-MW-09S
Sample ID	GWQC	MCL	MA-MW-9S-R2	MA-MW-9S-R2
Sample Date			09/19/2002	09/19/2002
Sample Interval			16 - 26 ft	16 - 26 ft
CLP Sample ID			MB0L25-Dissolved	MB0L26
Chemical Name				
Metals (ug/L)				
Aluminum	200			317 (A)
Antimony	20	6		
Arsenic	8	10		3.9 B
Barium	2000	2000	141 B	186 B
Beryllium	20	4		
Cadmium	4	5	3.3 B	6.8 (AB)
Chromium	100	100	1.9 B	3.7 B
Iron	300			1120 (A)
Lead	10	15		5.1
Manganese	50		715 J (A)	509 J (A)
Metals (mg/l)				
Sodium	50		101000 J (A)	69500 J (A)
Metals (ug/L)				
Sodium	50000		101000 J (A)	69500 J (A)
Thallium	10	2	2.8 B (B)	

B - Analyte detected in associated blank
J - Reported value is estimated in quantity
(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

05/20/2004

Table 5-12
Groundwater - PCB and Pesticide Results Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	MA-MW-12S	MA-MW-13S	MA-MW-14S	MA-MW-14S
Sample ID	GWQC	MCL	MA-MW-12S-R1	MA-MW-13S-R1	MA-MW-14S-R1	MA-MW-14S-R2-D
Sample Date			06/18/2002	06/28/2002	06/18/2002	09/24/2002
Sample Interval			5.4 - 15.4 ft	6.6 - 16.6 ft	7 - 20 ft	7 - 20 ft
CLP Sample ID			B0KX9	B0KX8	B0KY4	B0QA9
Chemical Name						
Pesticides and PCBs (ug/L)						
Dieldrin	0.03		0.099 J (A)	0.032 NJ (A)	0.057 J (A)	0.064 NJ (A)

J - Reported value is estimated in quantity

N - Quality control sample spike recovery for this analyte was outside specified limits

(A, B) - Exceeds criteria

Exceedences highlighted

GWQC - Groundwater Quality Criteria

MCL - Maximum Contaminant Level

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Table 5-13
Groundwater - Camden City Well 7 - Analytes Above Criteria
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report - May 2004

Station ID	(A)	(B)	CW-07	CW-07
Sample ID	GWQC	MCL	MA-CW07-070202	MA-CW07-092402
Sample Date			07/02/2002	09/24/2002
Sample Interval			N/A	N/A
CLP Sample ID			MB0KR7	MB0L34
Chemical Name				
Metals (ug/L)				
Iron	300		16900 (A)	16500 (A)
Manganese	50		332 (A)	352 (A)

302065

(A, B) - Exceeds criteria
Exceedences highlighted

GWQC - Groundwater Quality Criteria
MCL - Maximum Contaminant Level

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302066



Legend

- Volatile Organic Compounds Above Criteria
- ▬ Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- ▨ Structures

Contaminant	Result (mg/Kg)
Benzene	0.1

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.064

Contaminant	Result (mg/Kg)
Benzene	0.26
Chlorobenzene	3.2
Dichloroethylene-1,2 cis	3.2
Tetrachloroethylene	1.2
Trichloroethylene	0.71
Vinyl chloride	0.32

Contaminant	Result (mg/Kg)
Dichloroethane-1,1	11
Dichloroethylene-1,2 cis	24
Tetrachloroethylene	26
Toluene	160
Trichloroethylene	60

Contaminant	Result (mg/Kg)
Vinyl chloride	0.035

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.064

Contaminant	Result (mg/Kg)
Dichloroethylene-1,2 cis	0.53
Tetrachloroethylene	11
Trichloroethylene	2.3

Contaminant	Screening Level (mg/Kg)
Benzene	0.03
Chlorobenzene	1.0
Chloroform	0.6
Dichloroethane-1,1	10
Dichloroethylene-1,2 cis	0.4
Methylene chloride	0.02
Tetrachloroethylene	0.06
Toluene	12
Trichlorobenzene-1,2,4	5.0
Trichloroethane-1,1,1	2.0
Trichloroethylene	0.06
Vinyl chloride	0.01

Note: All constituents were compared to the USEPA DAF 20 soil criteria screening levels, with the exception of Dichloroethane-1,1. Dichloroethane-1,1 was compared to the New Jersey Department of Environmental Protection's Impact to Groundwater soil screening criteria.

Contaminant	Result (mg/Kg)
Methylene chloride	0.071
Tetrachloroethylene	0.062

Contaminant	Result (mg/Kg)
Benzene	4.5
Chloroform	1.4
Dichloroethylene-1,2 cis	0.74
Tetrachloroethylene	3.7
Trichlorobenzene-1,2,4	5.9
Trichloroethylene	7.9

0 25 50 100
Feet

Figure 5-1
Volatile Organic Compounds Exceeding Screening Levels
Surface Soil Samples
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- Benzene Isopleth in mg/Kg
- 0.26J Soil Sample Location with Concentrations in mg/Kg
- SB - Soil Boring
- SO - Soil Boring (locations same as boring location in NJDEP RI)
- ND - Not detected
- J - Estimated in quantity
- Soil Screening Criteria**
- EPA - 0.03 mg/Kg
- NRDCSCC - 13 mg/Kg
- IGWSCC - 1 mg/Kg

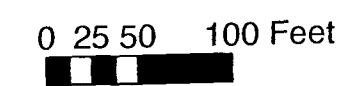
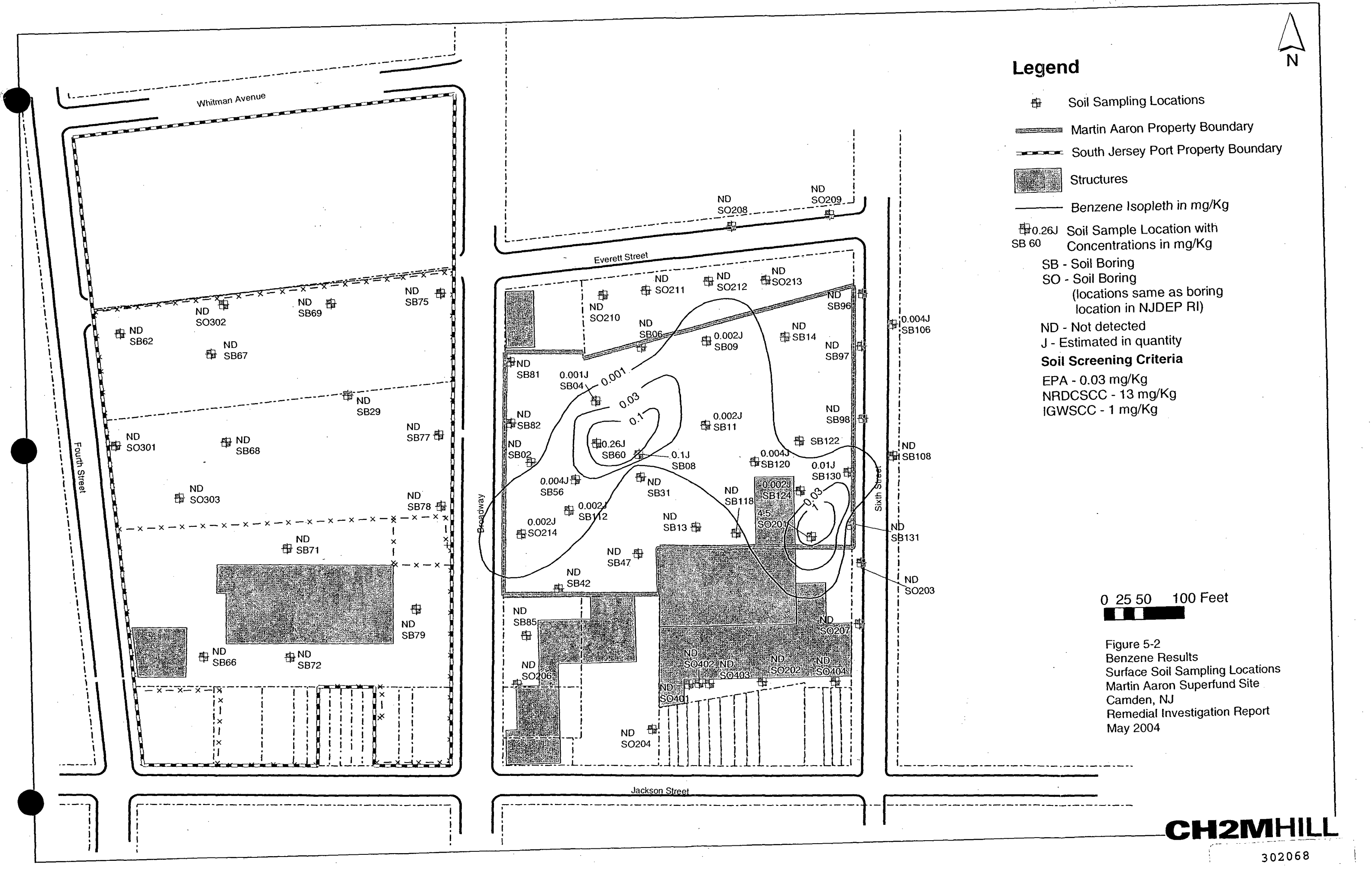


Figure 5-2
Benzene Results
Surface Soil Sampling Locations
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend



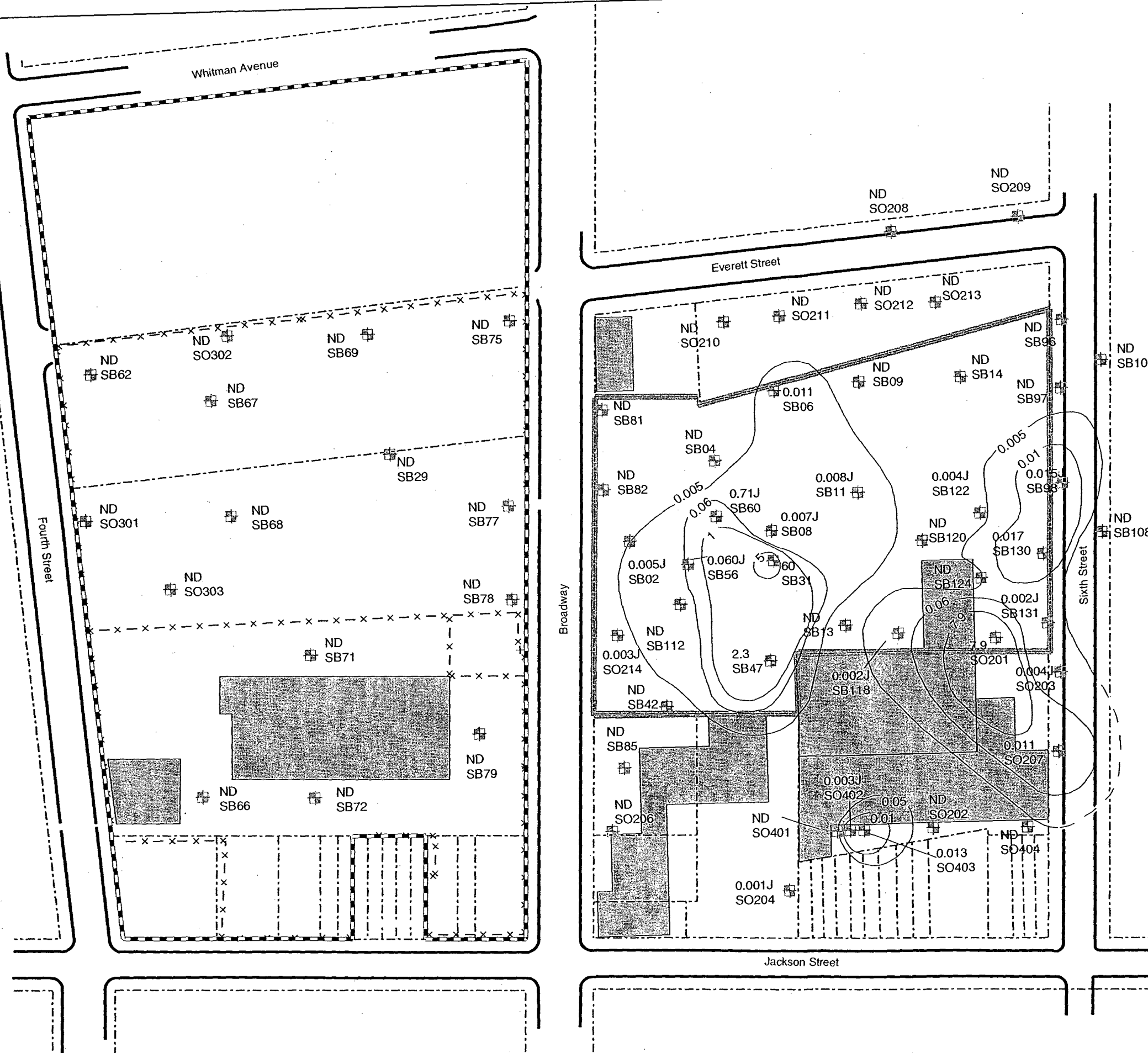
- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- Trichloroethylene Isopleth in mg/Kg
- Inferred Trichloroethylene Isopleth in mg/Kg
- 60
SB 31 Soil Sample Location with Concentrations in mg/Kg

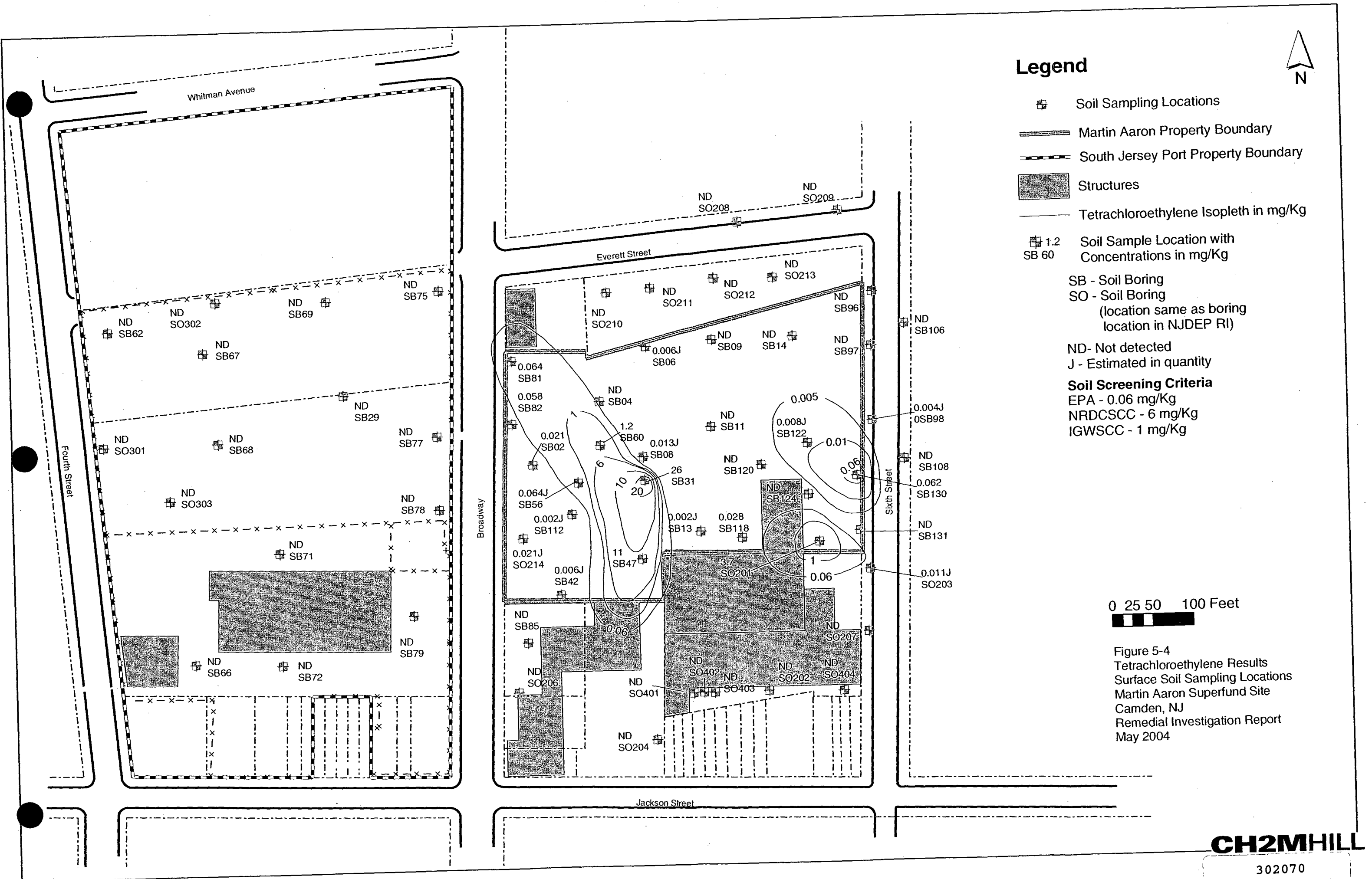
SB - Soil Boring
SO - Soil Boring
(locations same as boring location in NJDEP RI)

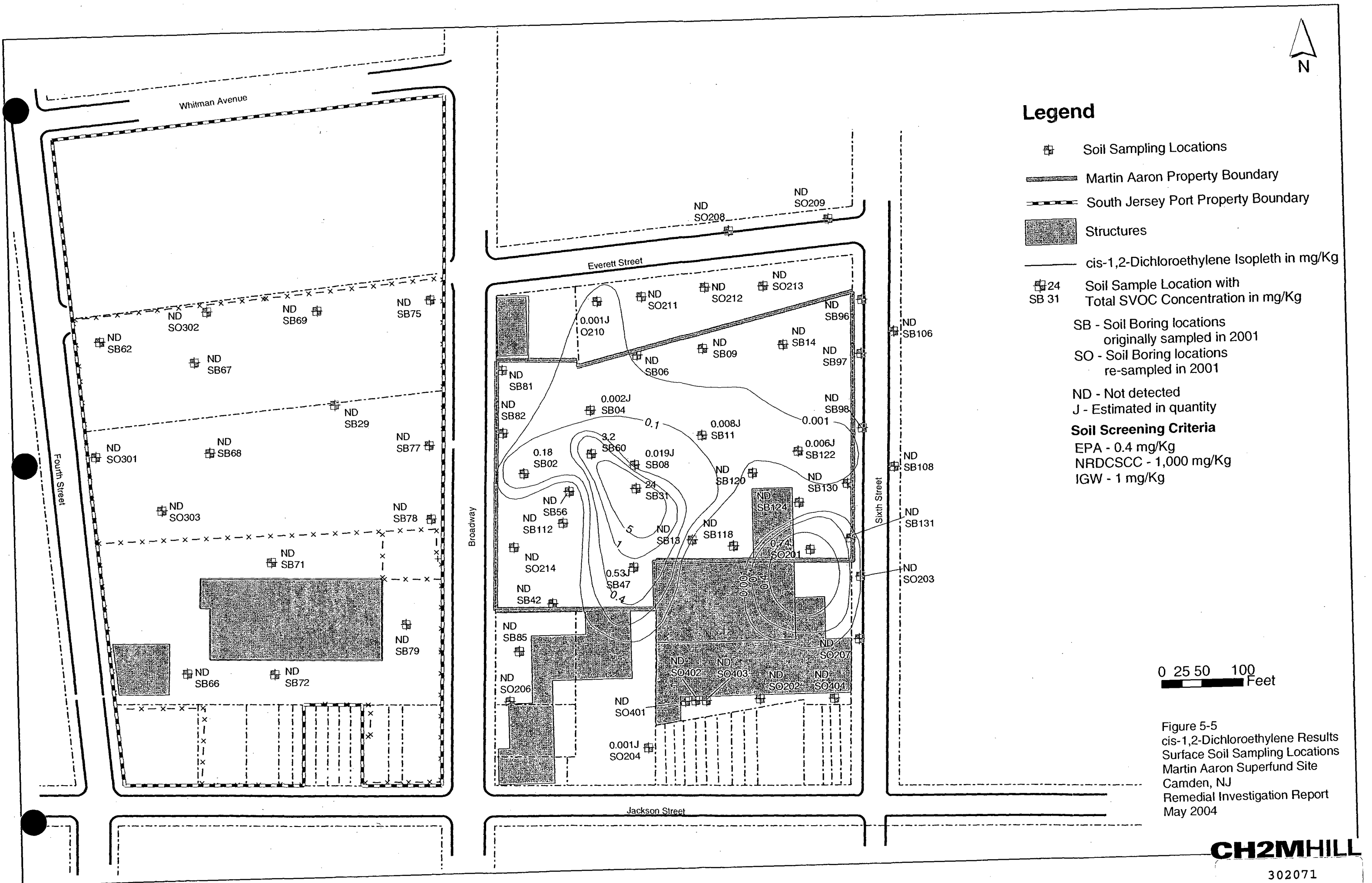
ND - Not detected
J - Estimated in quantity
Soil Screening Criteria
EPA - 0.06 mg/Kg
NRDCSCC - 54 mg/Kg
IGWSCC - 1 mg/Kg

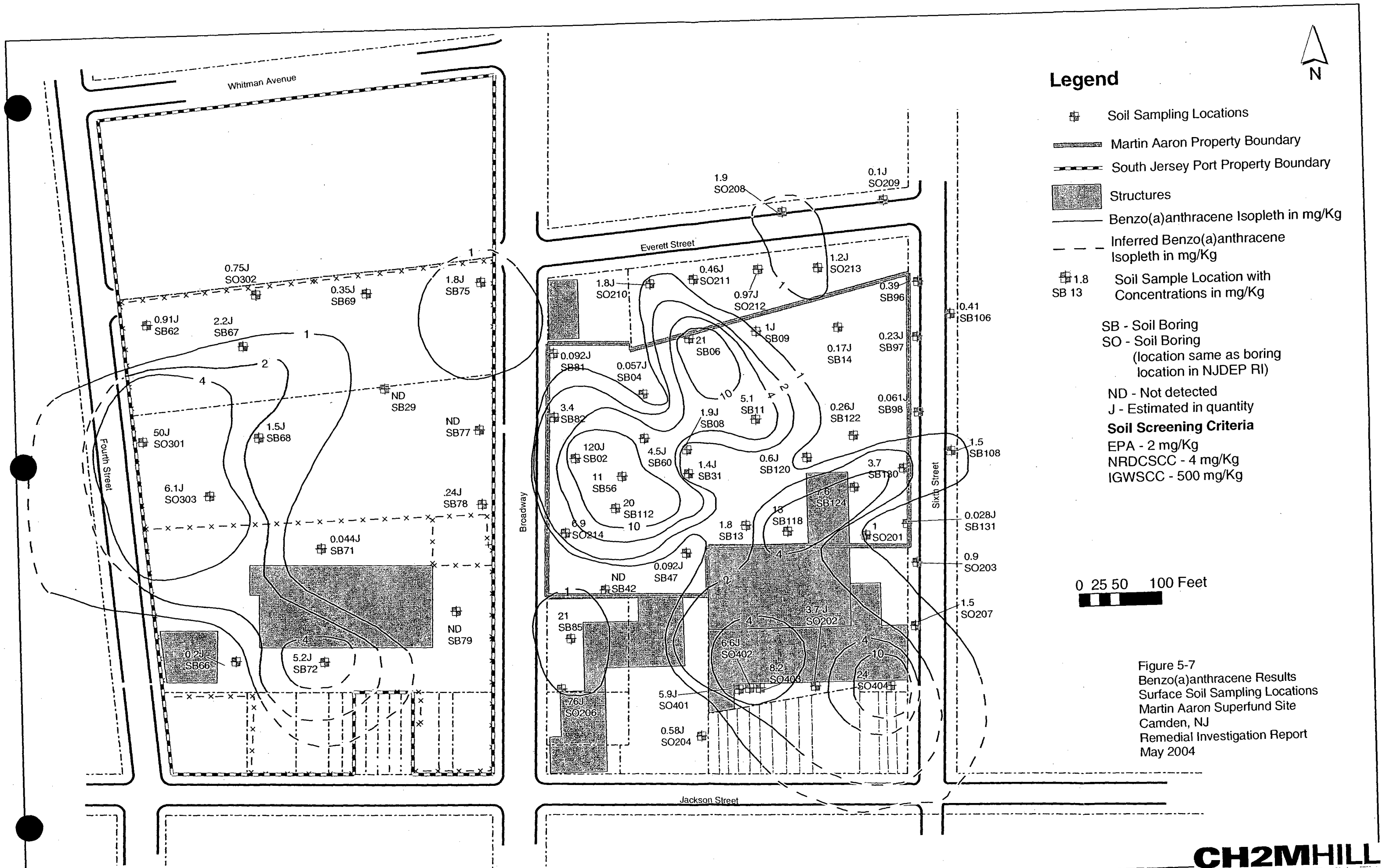
0 25 50 100 Feet

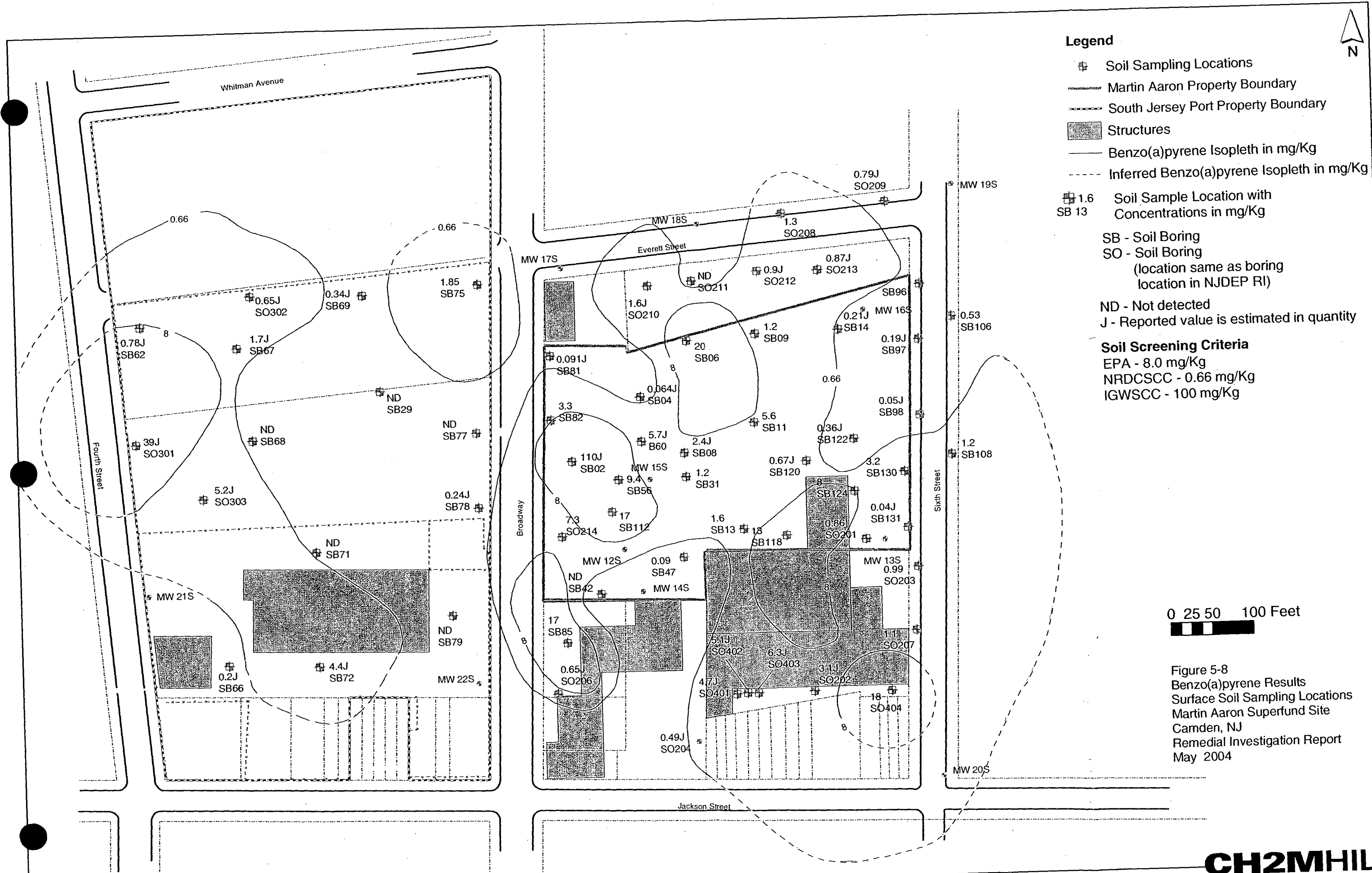
Figure 5-3
TCE Results
Surface Soil Samples
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

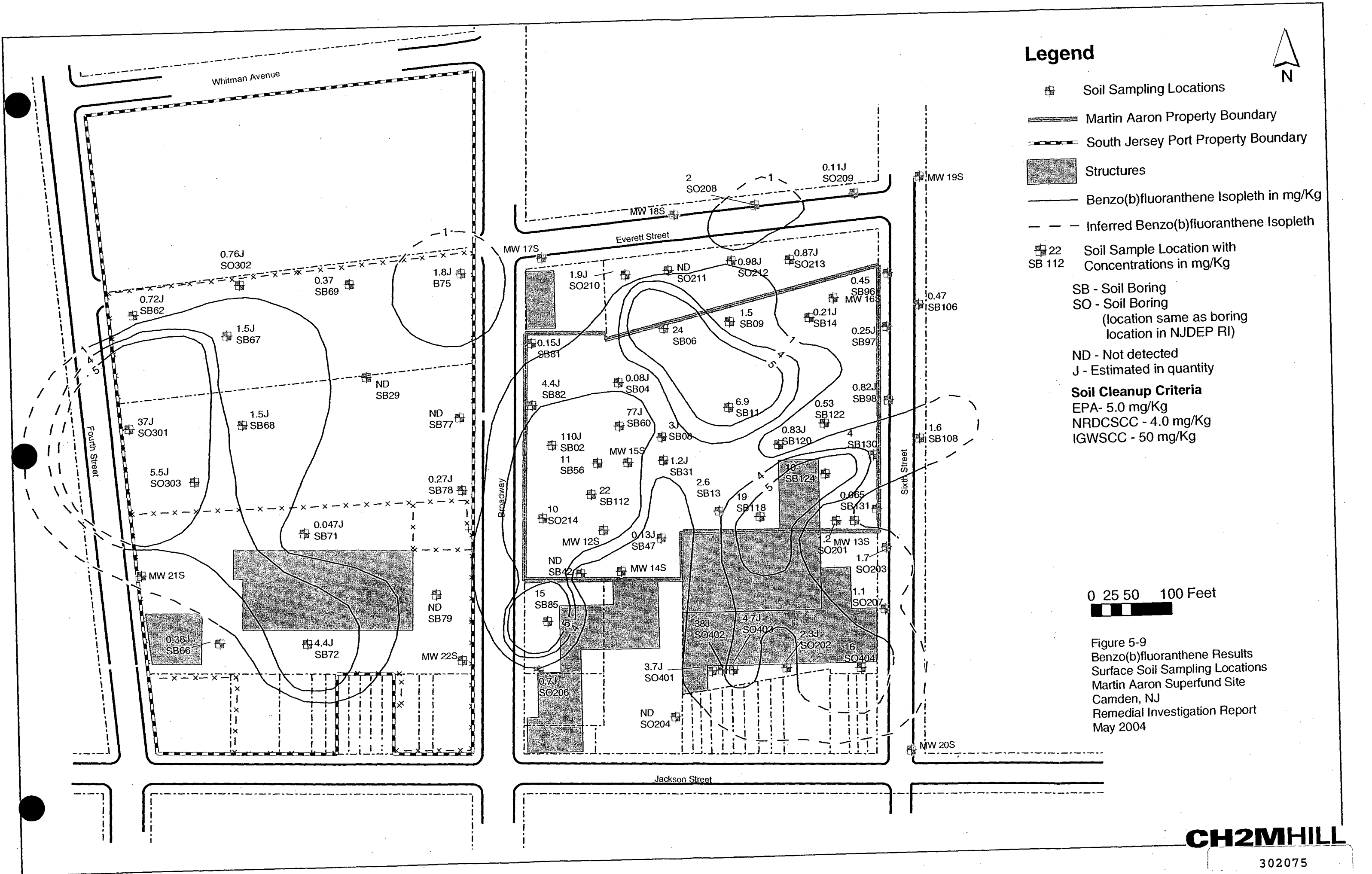


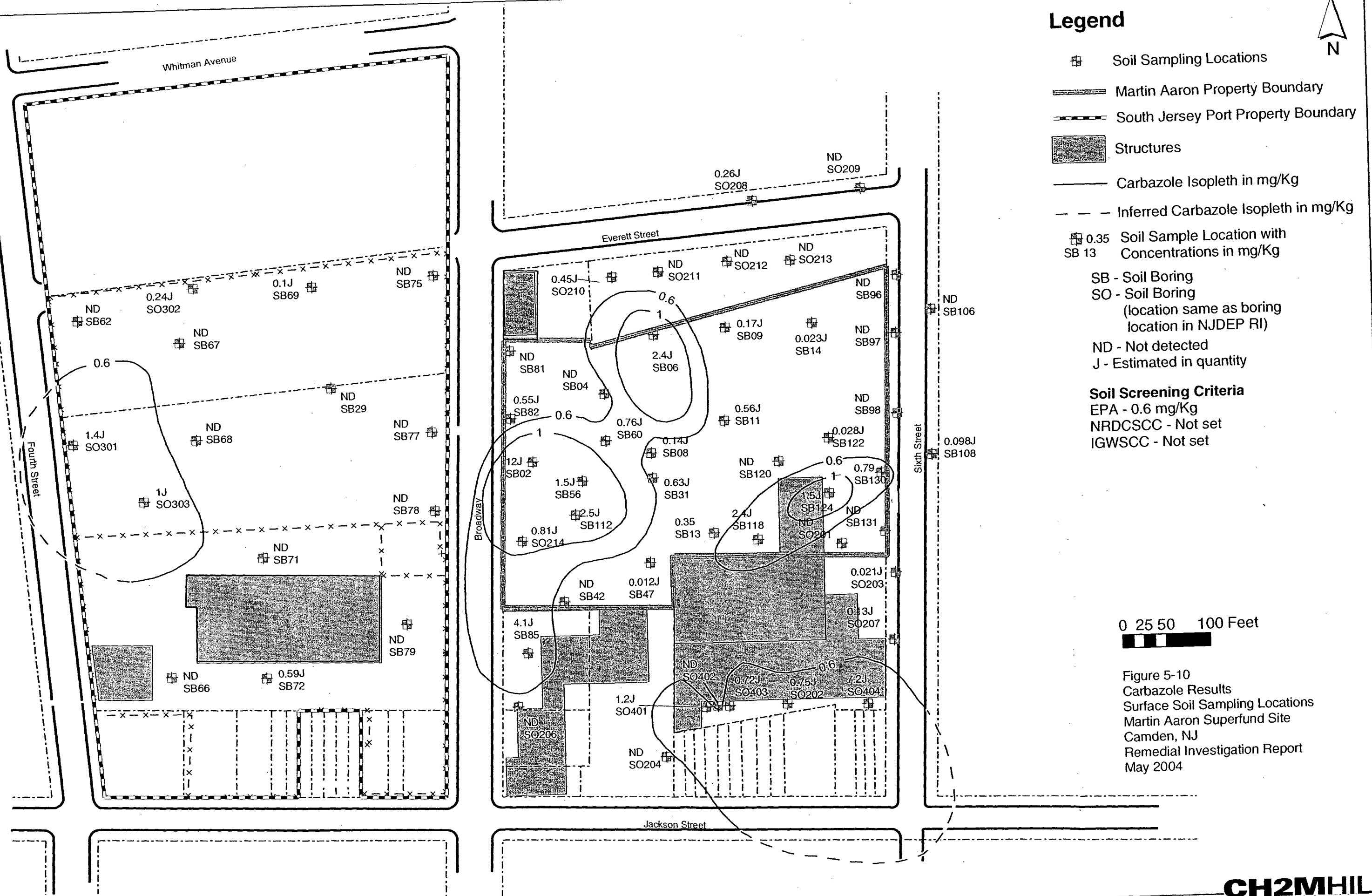


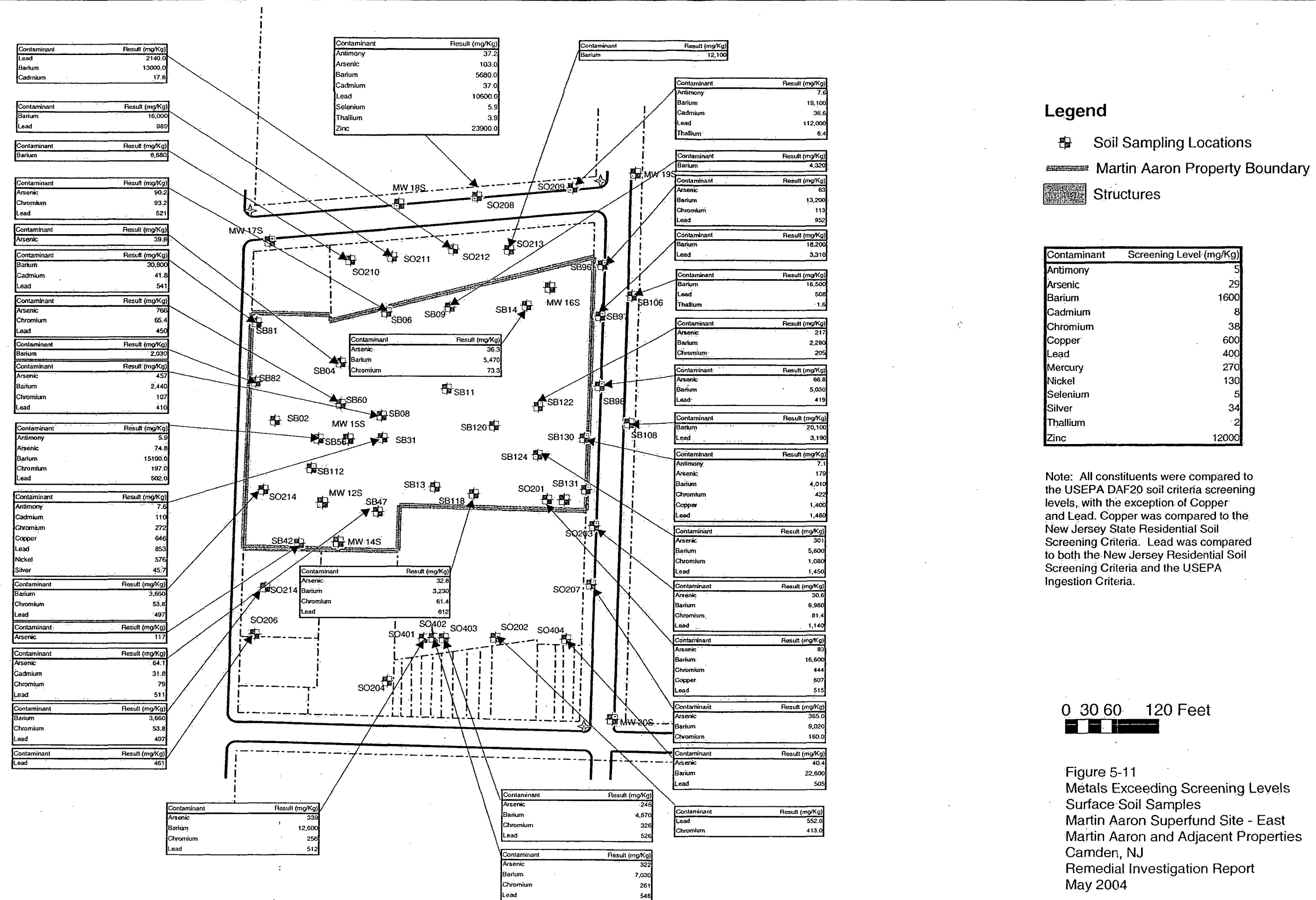












Contaminant	Result (mg/Kg)
Lead	1,020

Contaminant	Result (mg/Kg)
Lead	979

Contaminant	Result (mg/Kg)
Arsenic	46.4

Contaminant	Result (mg/Kg)
Barium	3,290
Lead	502

Contaminant	Result (mg/Kg)
Arsenic	33.8
Lead	541

Contaminant	Result (mg/Kg)
Barium	4,410

Contaminant	Result (mg/Kg)
Lead	758

Contaminant	Result (mg/Kg)
Barium	3,050
Chromium	75

Contaminant	Result (mg/Kg)
Arsenic	33.1
Barium	2,460
Chromium	189
Lead	872

Contaminant	Result (mg/Kg)
Barium	5,070
Lead	588

Legend

★ Metals Above Criteria

--- South Jersey Port Property Boundary

■ Structures

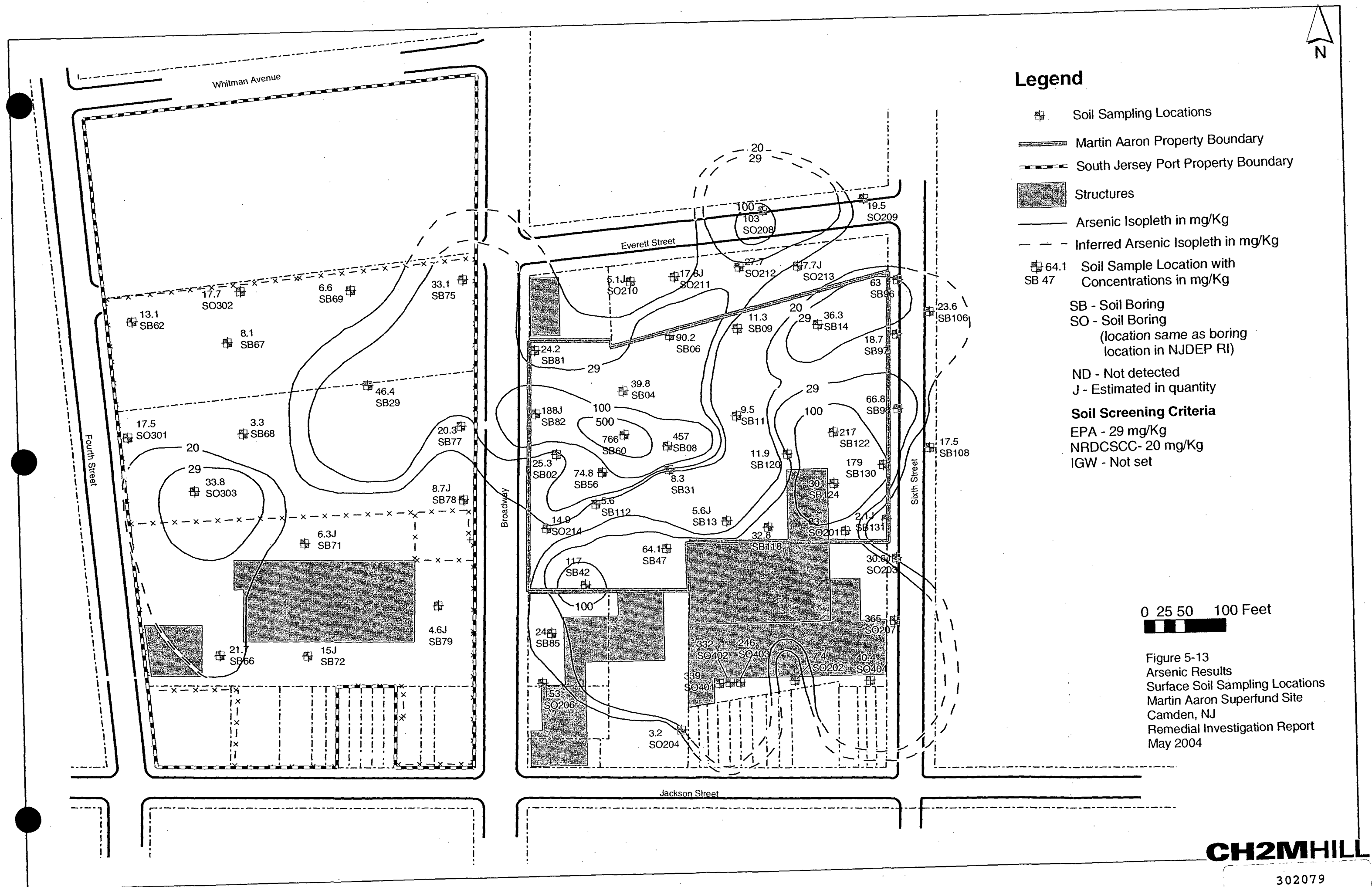
Contaminant	Screening Level (mg/Kg)
Arsenic	29
Barium	1,600
Chromium	38
Lead	400

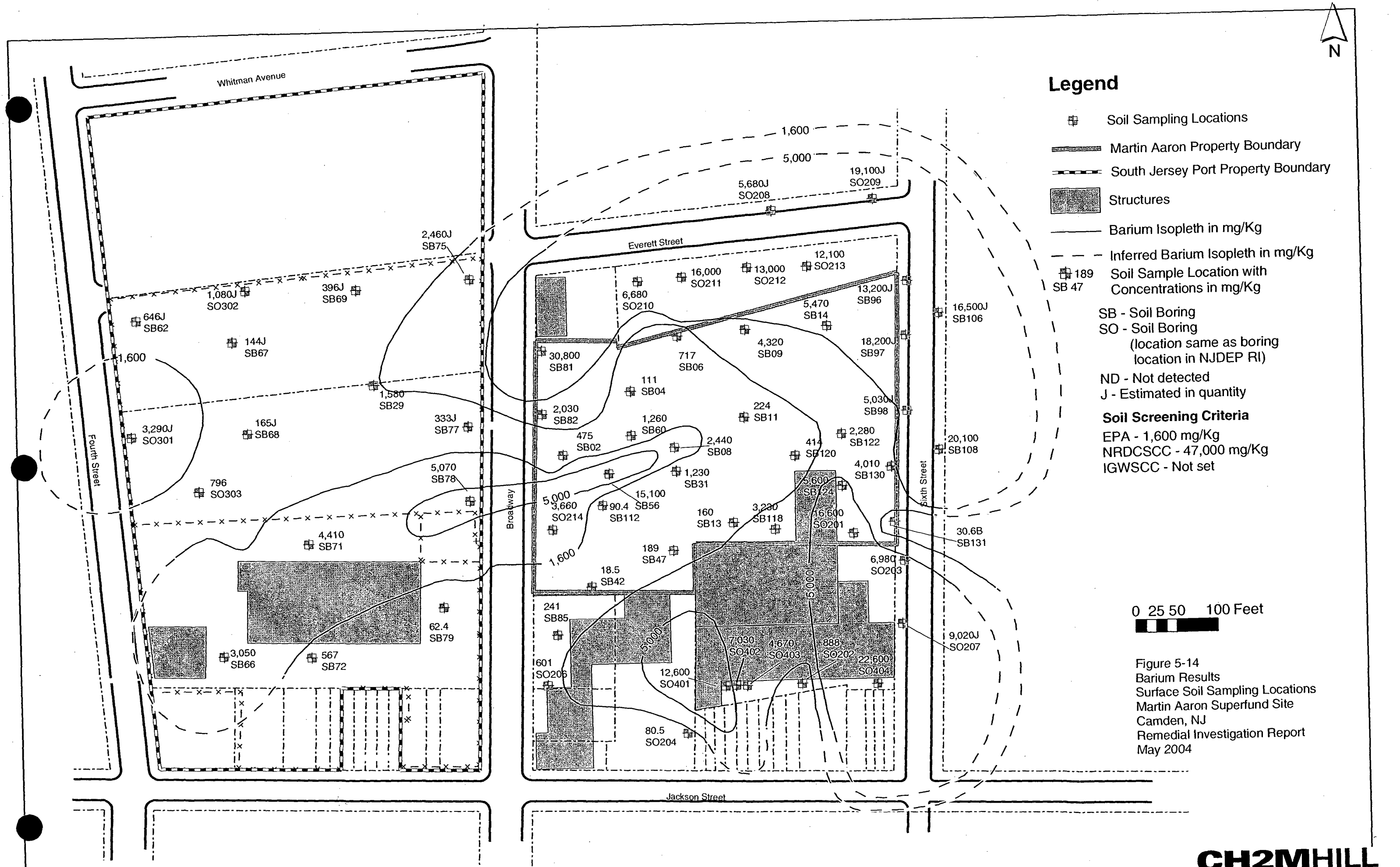
Note: All constituents were compared to the USEPA DAF20 soil criteria screening levels, with the exception of Lead. Lead was compared to both the New Jersey Residential Soil Screening Criteria and the USEPA Ingestion Criteria.

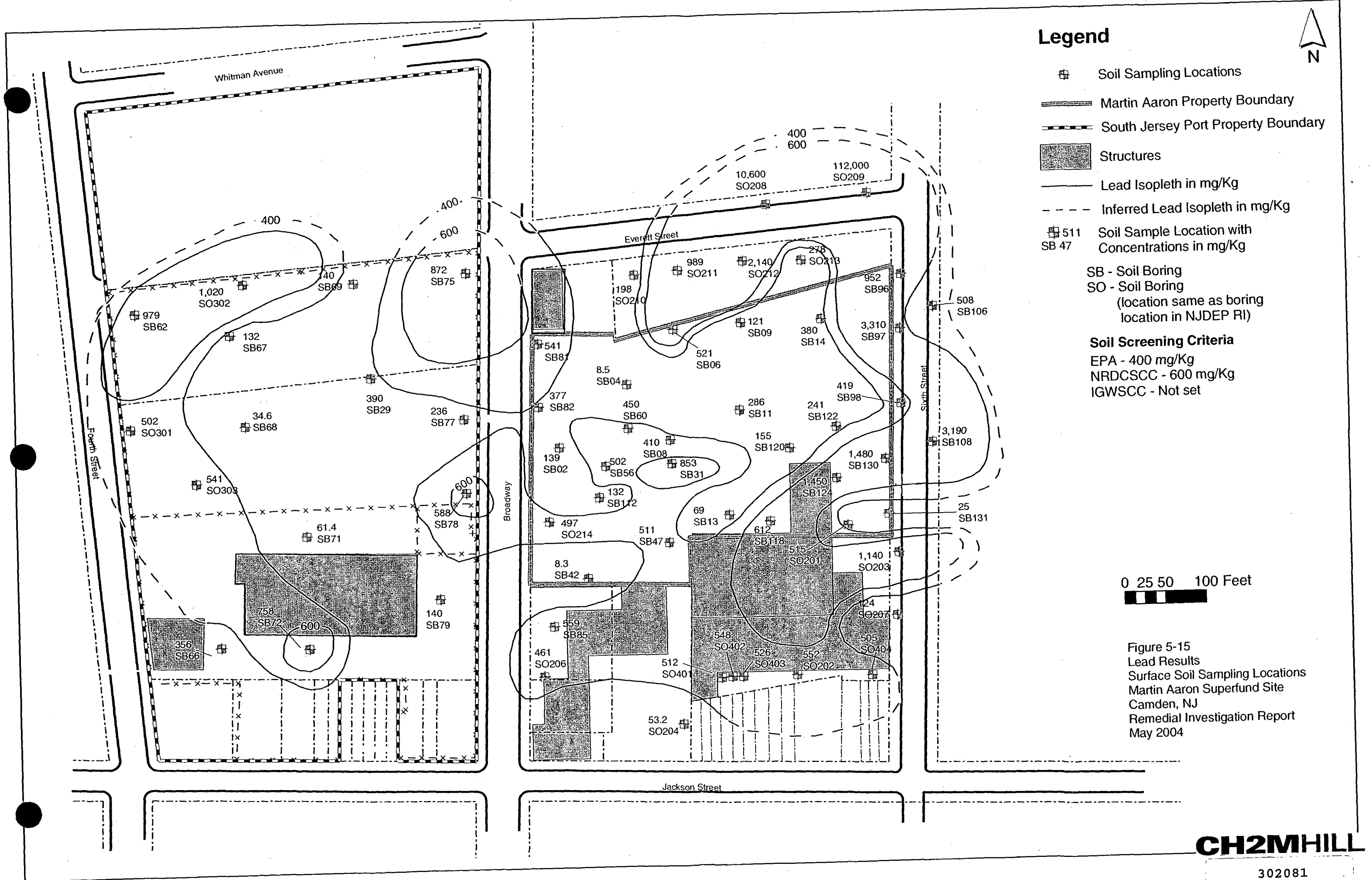
0 25 50 100 Feet

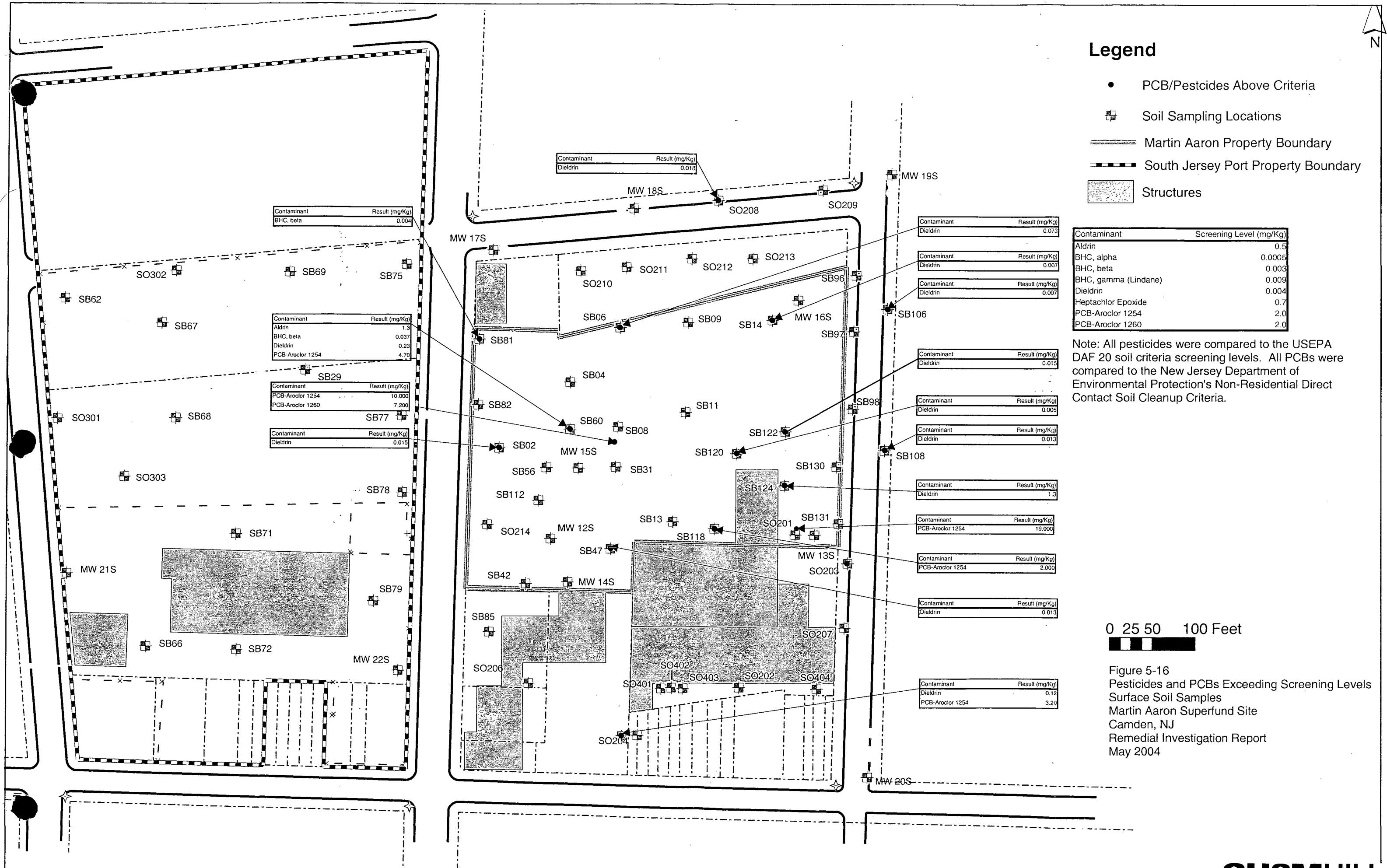


Figure 5-12
Metals Exceeding Screening Levels
Surface Soil Samples
Martin Aaron Superfund Site - West
South Jersey Port Property
Camden, NJ
Remedial Investigation Report
May 2004









Legend

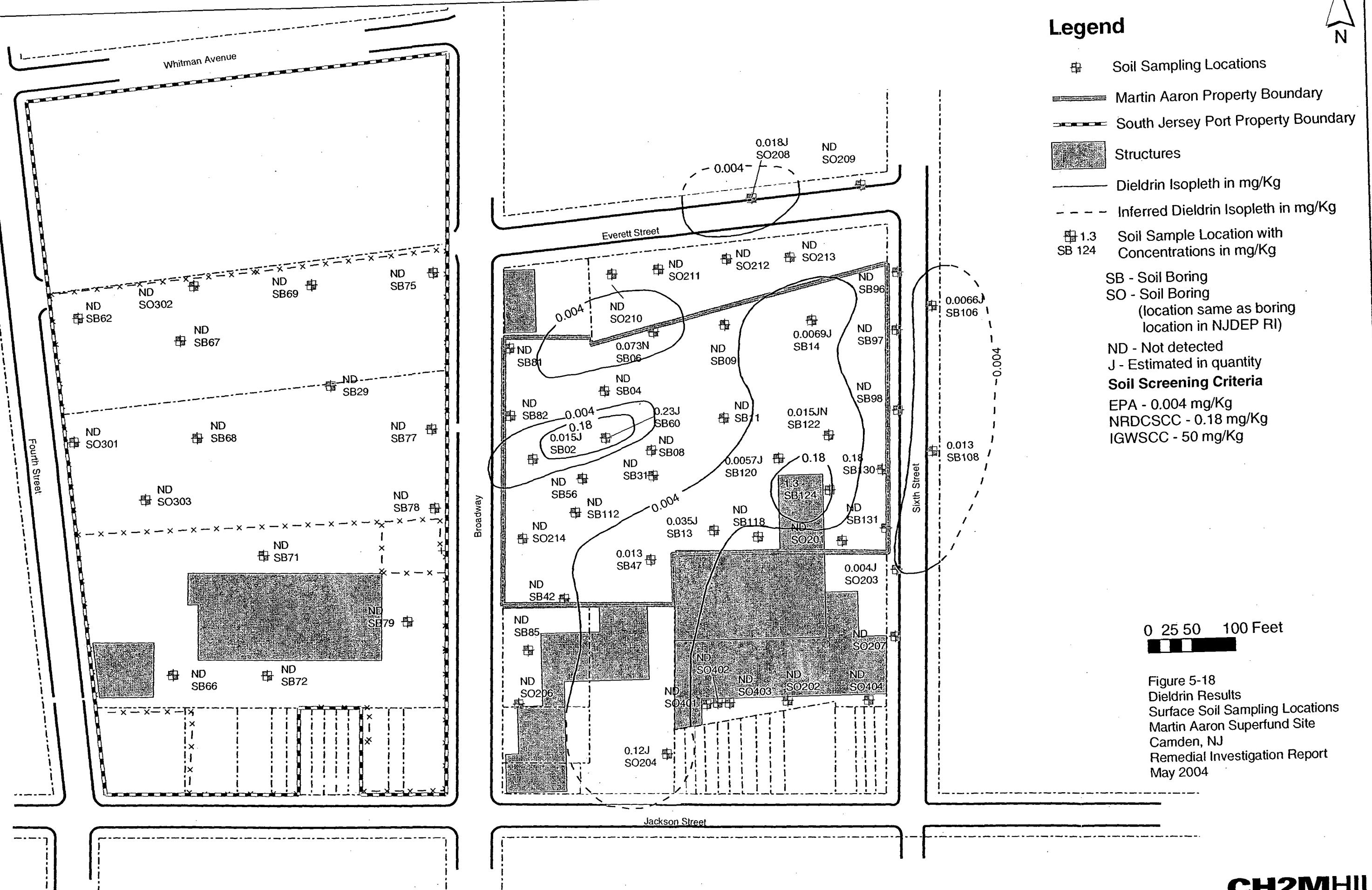
- PCB/Pesticides Above Criteria
- Soil Sampling Locations
- ===== Martin Aaron Property Boundary
- - - - - South Jersey Port Property Boundary
- ▒ Structures

Contaminant	Screening Level (mg/Kg)
Aldrin	0.5
BHC, alpha	0.0005
BHC, beta	0.003
BHC, gamma (Lindane)	0.009
Dieldrin	0.004
Heptachlor Epoxide	0.7
PCB-Aroclor 1254	2.0
PCB-Aroclor 1260	2.0

Note: All pesticides were compared to the USEPA DAF 20 soil criteria screening levels. All PCBs were compared to the New Jersey Department of Environmental Protection's Non-Residential Direct Contact Soil Cleanup Criteria.

0 25 50 100 Feet

Figure 5-16
Pesticides and PCBs Exceeding Screening Levels
Surface Soil Samples
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





Legend

- Volatile Organic Compounds Above Criteria
- ⊠ Soil Sampling Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- ▒ Structures

Contaminant	Result (mg/Kg)
Benzene	0.067

Contaminant	Result (mg/Kg)
Bromomethane	0.52

Contaminant	Result (mg/Kg)
Dichloroethene-1,2 trans	1.6
Dichloroethylene-1,2 cis	13
Dichloroethylene-1,1	0.13
Trichloroethylene	630
Vinyl chloride	0.48

Contaminant	Result (mg/Kg)
Vinyl chloride	0.059

Contaminant	Result (mg/Kg)
Benzene	0.26

Contaminant	Result (mg/Kg)
Benzene	0.7

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.069

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.47

Contaminant	Result (mg/Kg)
Benzene	0.076
Trichloroethylene	0.063

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.27
Trichloroethylene	0.071

Contaminant	Result (mg/Kg)
Tetrachloroethylene	1.1
Methylene chloride	0.14
Trichloroethylene	0.23

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.45

Contaminant	Result (mg/Kg)
Dichloroethylene-1,2 cis	11
Tetrachloroethylene	110
Trichloroethylene	20

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.13

Contaminant	Result (mg/Kg)
Trichloroethylene	0.22

Contaminant	Result (mg/Kg)
Vinyl chloride	0.012

Contaminant	Result (mg/Kg)
Methylene chloride	0.043

Contaminant	Result (mg/Kg)
Methylene chloride	0.11

Contaminant	Result (mg/Kg)
Tetrachloroethylene	0.32

Contaminant	Result (mg/Kg)
Benzene	31
Chloroform	16
Ethylbenzene	29
Tetrachloroethylene	43
Toluene	49
Trichlorobenzene-1,2,4	14
Trichloroethane-1,1,1	3.3
Trichloroethylene	15
Xylenes, total	220

Contaminant	Result (mg/Kg)
Benzene	0.21
Vinyl chloride	0.015

Contaminant	Screening Level (mg/Kg)
Benzene	0.03
Bromomethane	0.2
Chloroform	0.6
Dichloroethylene-1,1	0.06
Dichloroethylene-1,2 cis	0.4
Ethylbenzene	13
Methylene chloride	0.02
Tetrachloroethylene	0.06
Toluene	12
Trichlorobenzene-1,2,4	5.0
Trichloroethane-1,1,1	2.0
Trichloroethylene	0.06
Vinyl chloride	0.01
Xylenes, total	67

Note: All constituents were compared to the USEPA DAF 20 soil criteria screening levels, with the exception of Total Xylenes. Total Xylenes were compared to the New Jersey State Impact to Groundwater Soil Screening Criteria.

0 25 50 100 Feet

Figure 5-20
Volatile Organic Compounds
Exceeding Screening Levels
Subsurface Soil Samples
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- VOC Isopleth in mg/Kg
- Inferred VOC isopleth in mg/Kg
- 0.901 SB82 Soil Sampling Locations with Total VOC Concentrations in mg/Kg
- SB - Soil Boring
- SO - Soil Boring (location same as boring location in NJDEP RI)

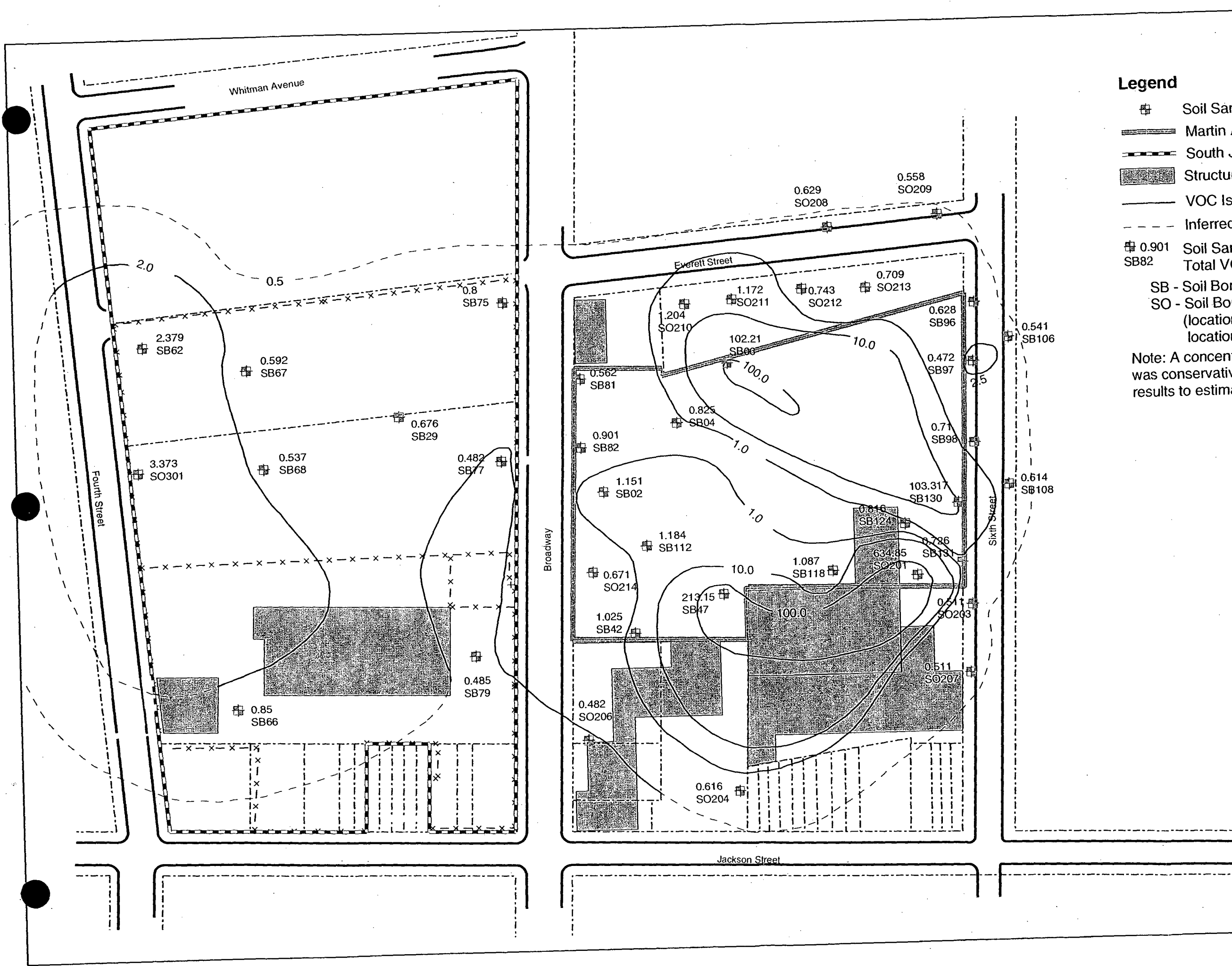
Note: A concentration equal to detection limit was conservatively assumed for all non-detect results to estimate total concentration.

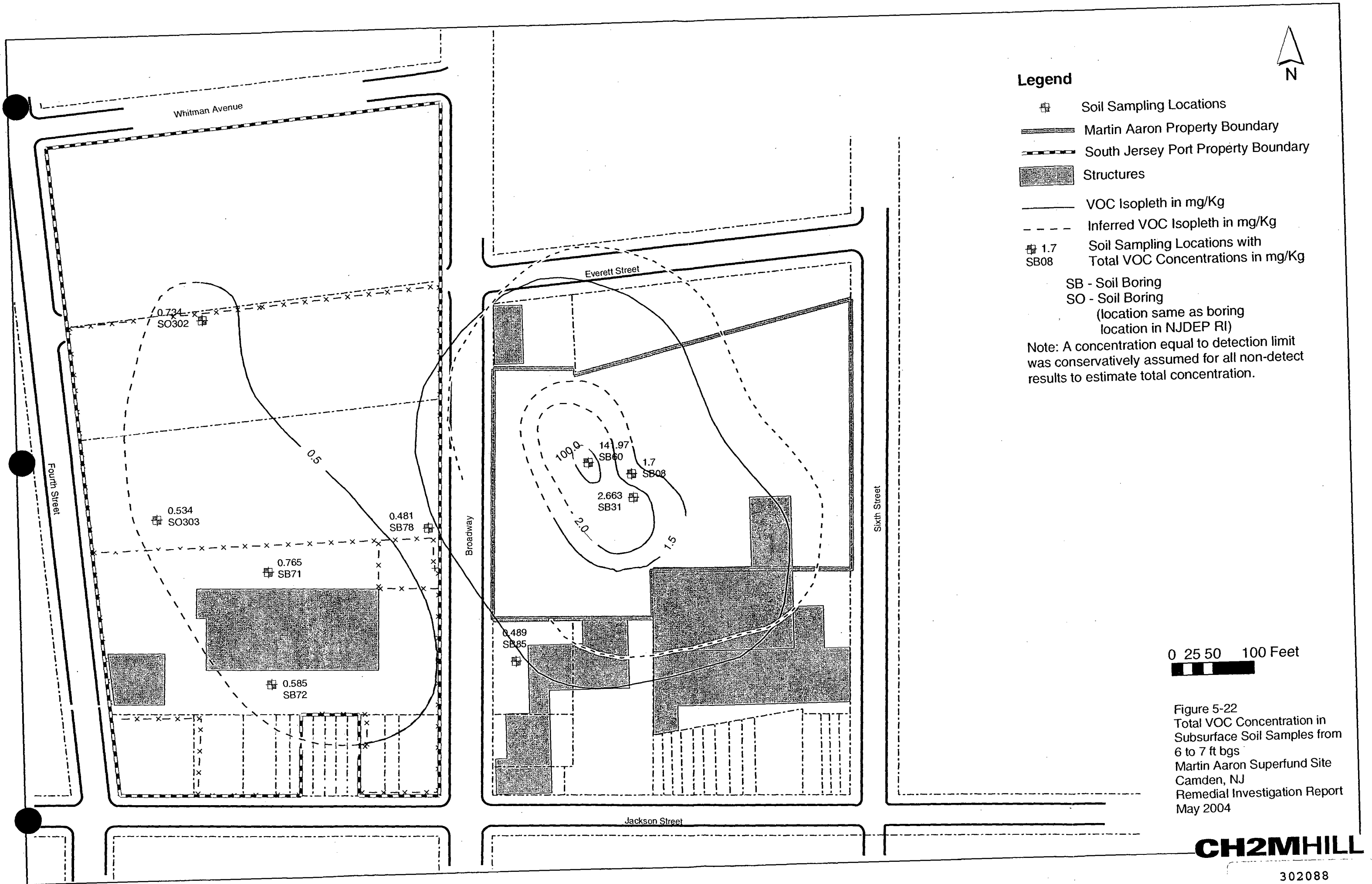
0 25 50 100 Feet

Figure 5-21
Total VOC Concentrations in
Subsurface Soil Samples from
4 to 5 ft bgs
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

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Legend

- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- VOC Isopleth in mg/Kg
- Inferred VOC Isopleth in mg/Kg
- 0.82 Soil Sampling Locations with
SB 13 Total VOC Concentrations in mg/Kg
- SB - Soil Boring
- SO - Soil Boring
(location same as boring
location in NJDEP RI)

Note: A concentration equal to detection limit
was conservatively assumed for all non-detect
results to estimate total concentration.

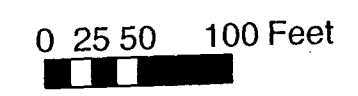
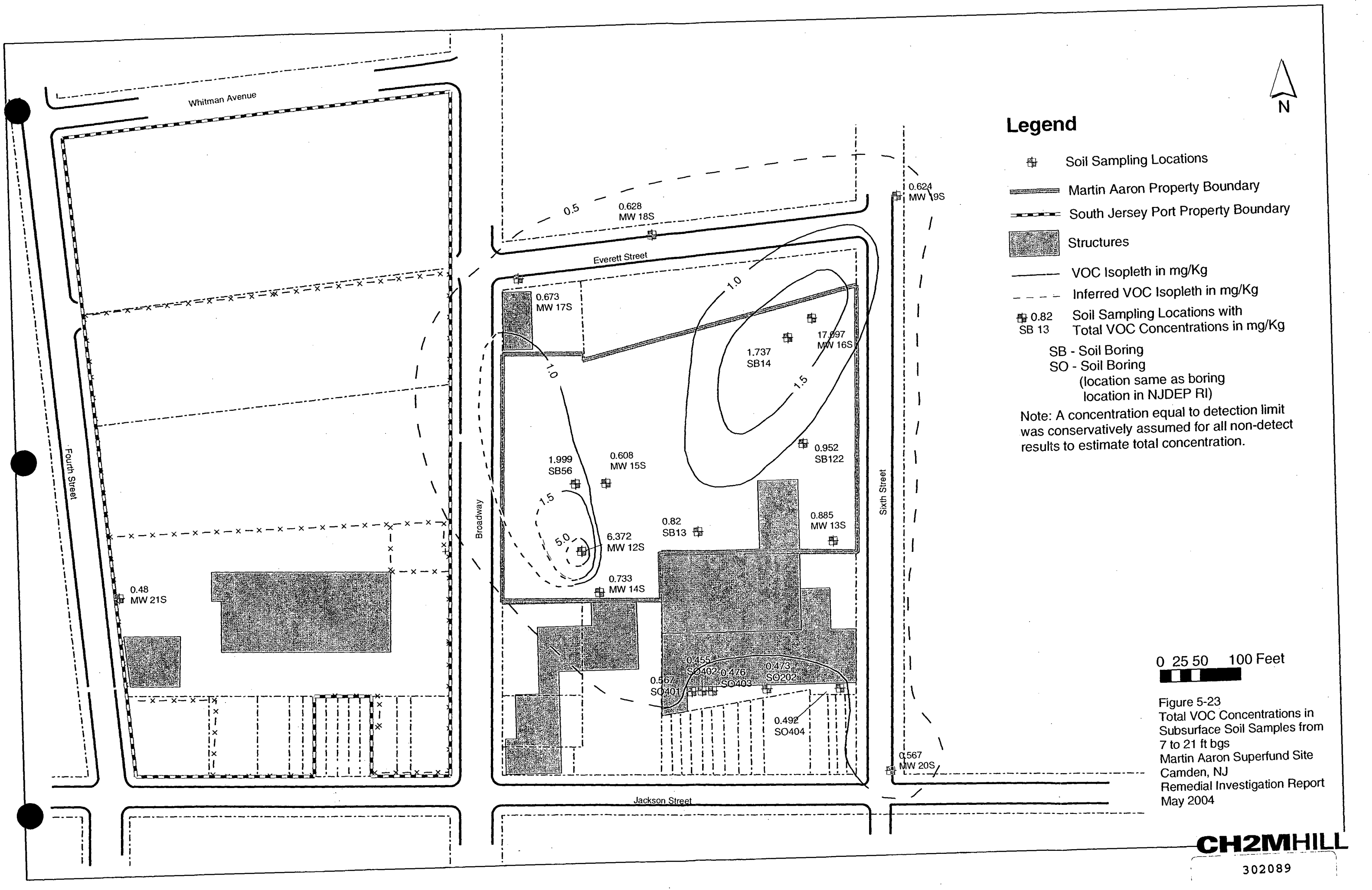
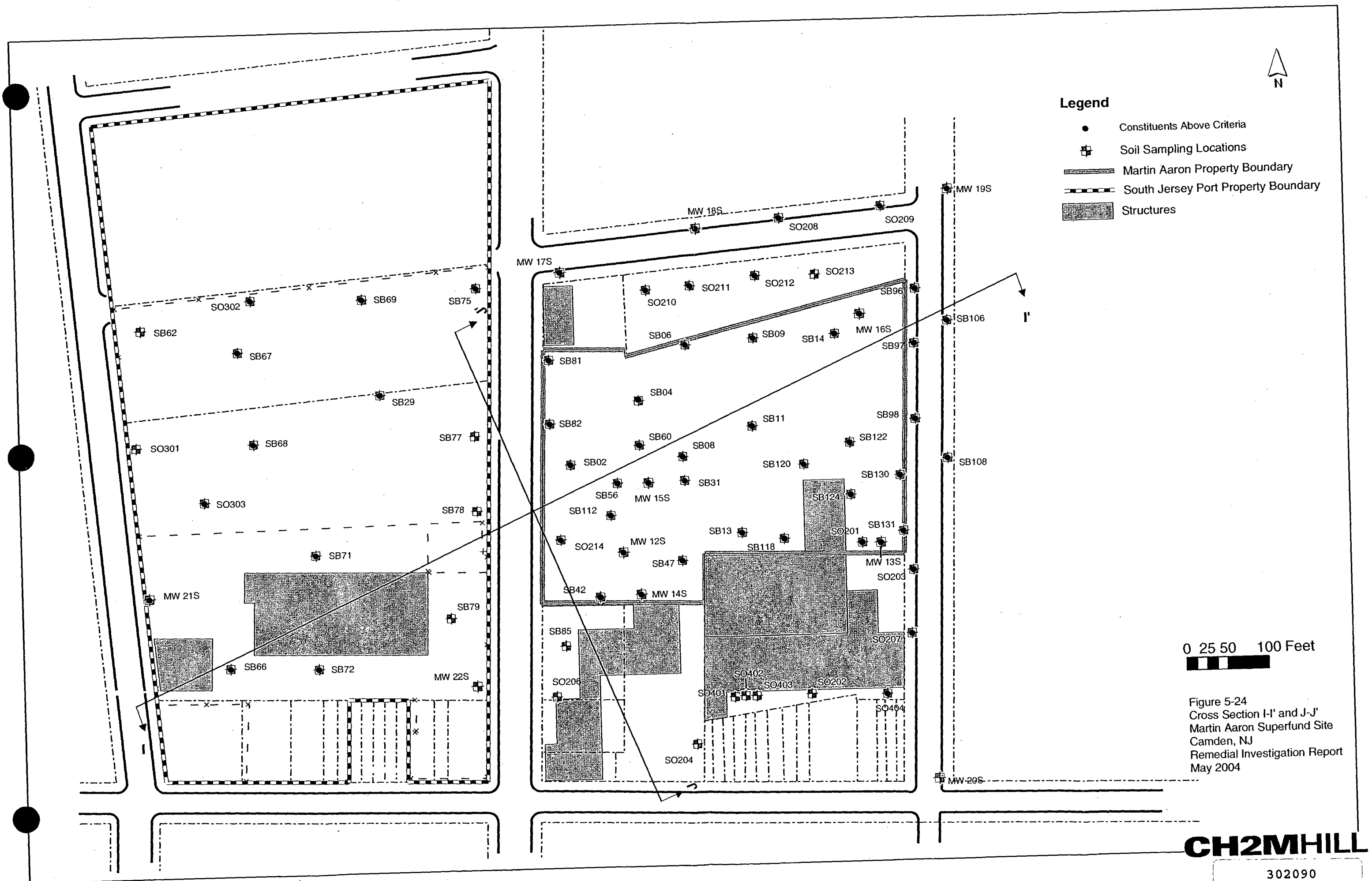


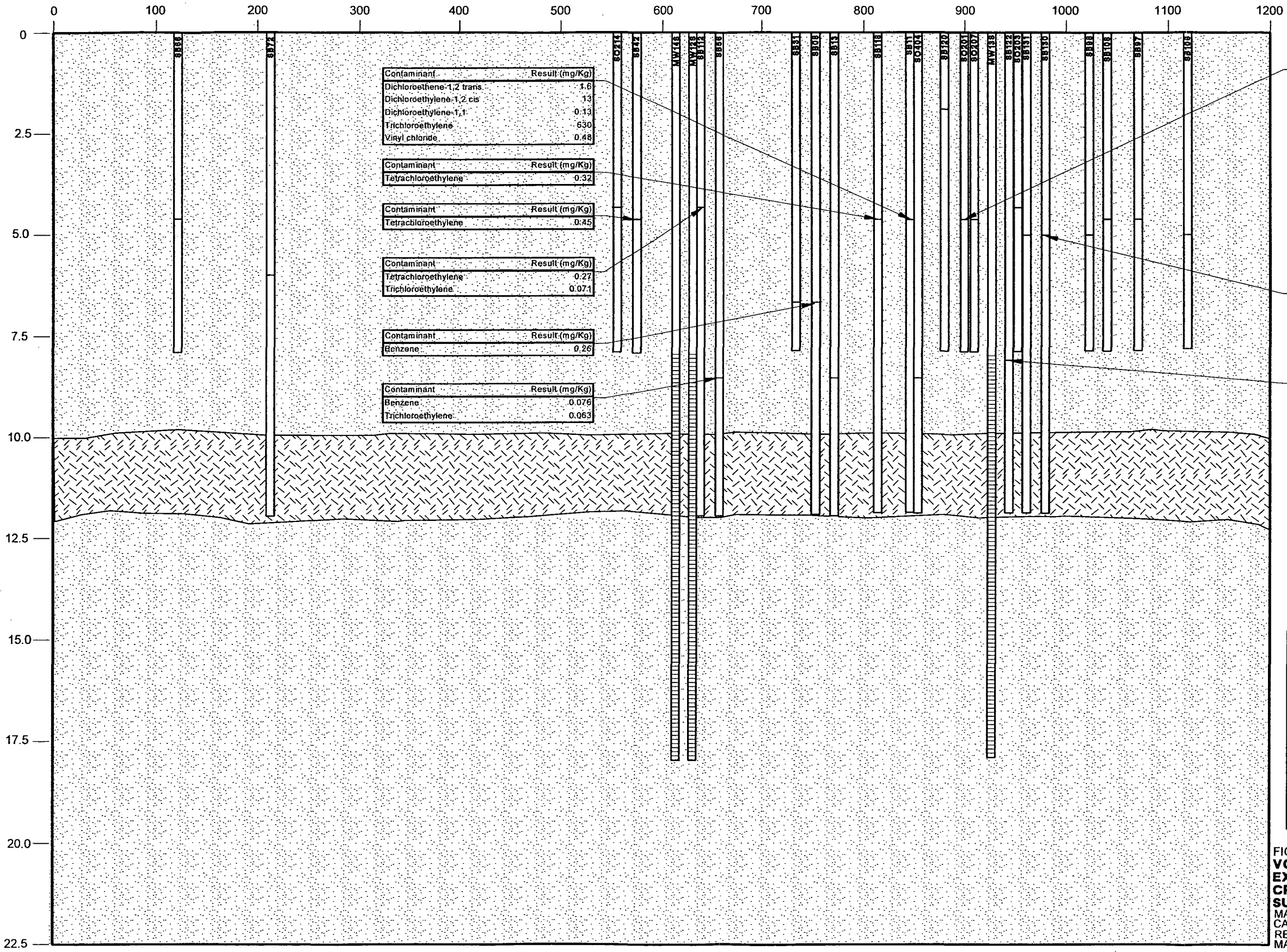
Figure 5-23
Total VOC Concentrations in
Subsurface Soil Samples from
7 to 21 ft bgs
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





(FEET)

DEPTH (FEET BGS)



Contaminant	Result (mg/Kg)
Benzene	31
Chloroform	16
Ethylbenzene	29
Tetrachloroethylene	43
Toluene	49
Trichlorobenzene-1,2,4	14
Trichloroethane-1,1,1	3.3
Trichloroethylene	15
Xylenes, total	220

Contaminant	Result (mg/Kg)
Methylene chloride	0.11

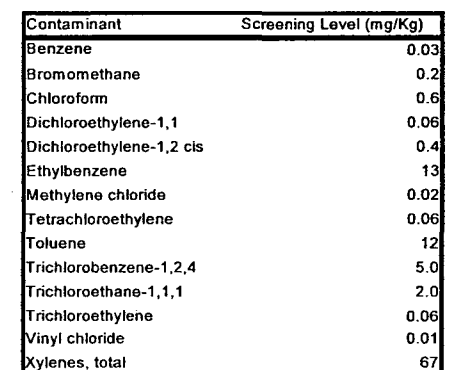
Contaminant	Result (mg/Kg)
Vinyl chloride	0.012

LEGEND

	CLAY
	SAND

Contaminant	Screening Level (mg/Kg)
Benzene	0.03
Bromomethane	0.2
Chloroform	0.6
Dichloroethylene-1,1	0.06
Dichloroethylene-1,2 cis	0.4
Ethylbenzene	13
Methylene chloride	0.02
Tetrachloroethylene	0.06
Toluene	12
Trichlorobenzene-1,2,4	5.0
Trichloroethane-1,1,1	2.0
Trichloroethylene	0.06
Vinyl chloride	0.01
Xylenes, total	67

FIGURE 5-25
VOLATILE ORGANIC COMPOUNDS
EXCEEDING SCREENING LEVELS
CROSS SECTION I - I'
SUBSURFACE SOIL
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIATION INVESTIGATION REPORT
MAY 2004



CH2MHILL

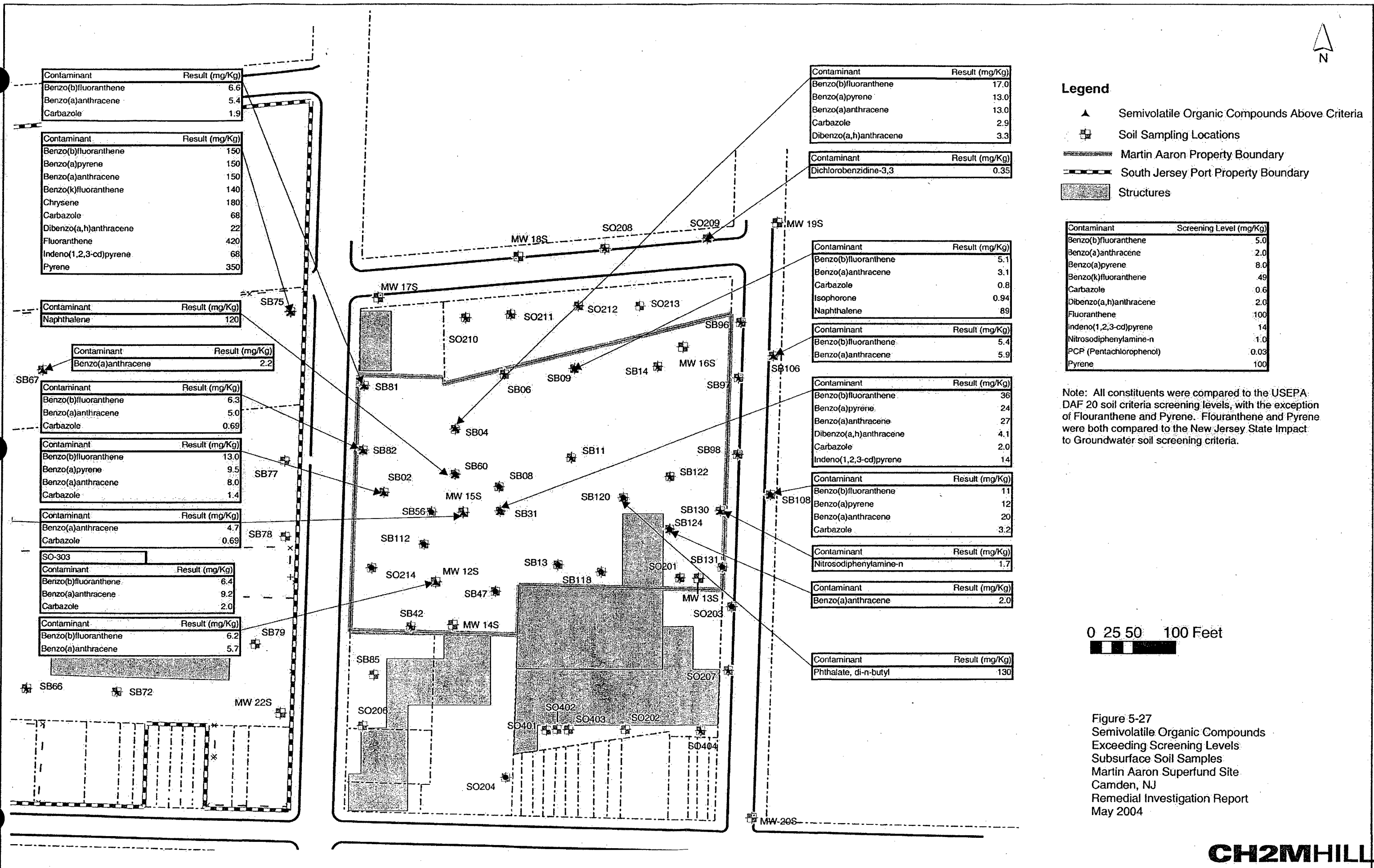


Figure 5-27
Semivolatile Organic Compounds
Exceeding Screening Levels
Subsurface Soil Samples
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Legend



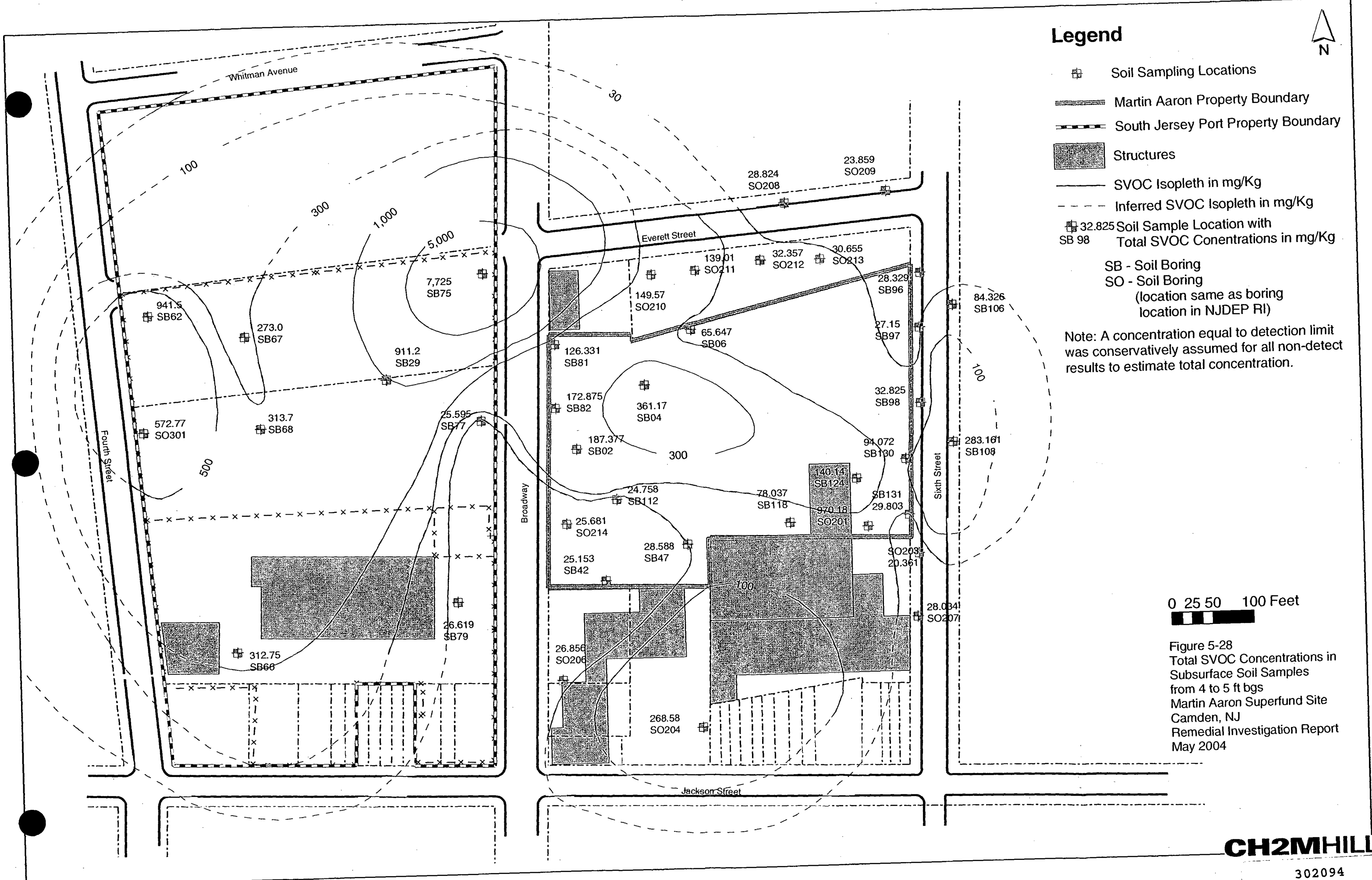
- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- SVOC Isopleth in mg/Kg
- Inferred SVOC Isopleth in mg/Kg
- 32.825 Soil Sample Location with SB 98 Total SVOC Concentrations in mg/Kg

SB - Soil Boring
SO - Soil Boring
(location same as boring location in NJDEP RI)

Note: A concentration equal to detection limit was conservatively assumed for all non-detect results to estimate total concentration.







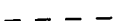

0 25 50 100 Feet

Figure 5-28
Total SVOC Concentrations in
Subsurface Soil Samples
from 4 to 5 ft bgs
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





Legend

-  Soil Sampling Locations
-  Martin Aaron Property Boundary
-  South Jersey Port Property Boundary
-  Structures
-  svoc_ss.dwg Polyline
-  SVOC Isopleth in mg/Kg
-  Inferred SVOC Isopleth in mg/Kg
-  22.697 Soil Sample Locations with
SB85 Total SVOC Concentrations in mg/Kg
- SB - Soil Boring
- SO - Soil Boring
(location same as boring
location in NJDEP RI)

Note: A concentration equal to detection limit
was conservatively assumed for all non-detect
results to estimate total concentration.


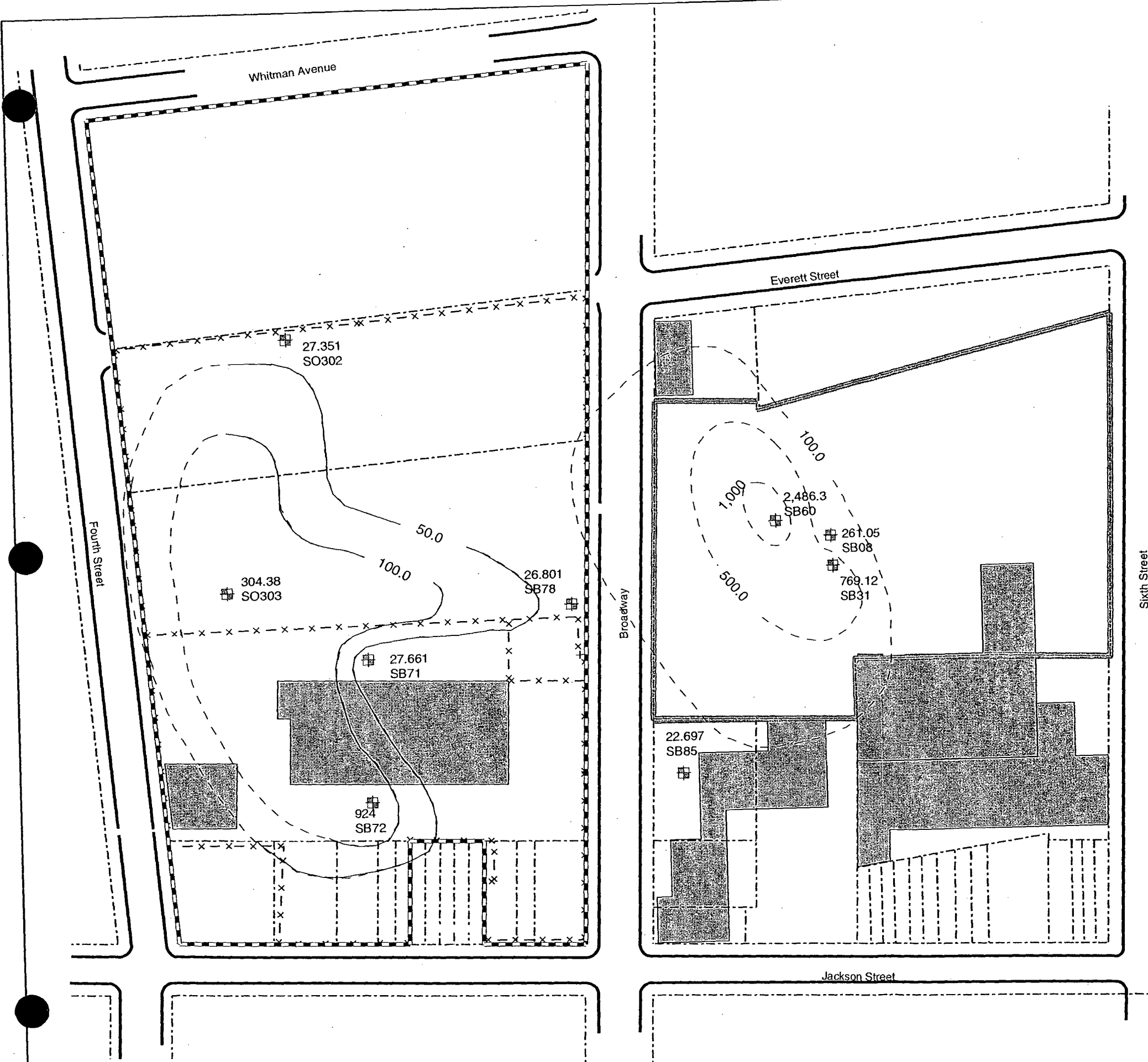
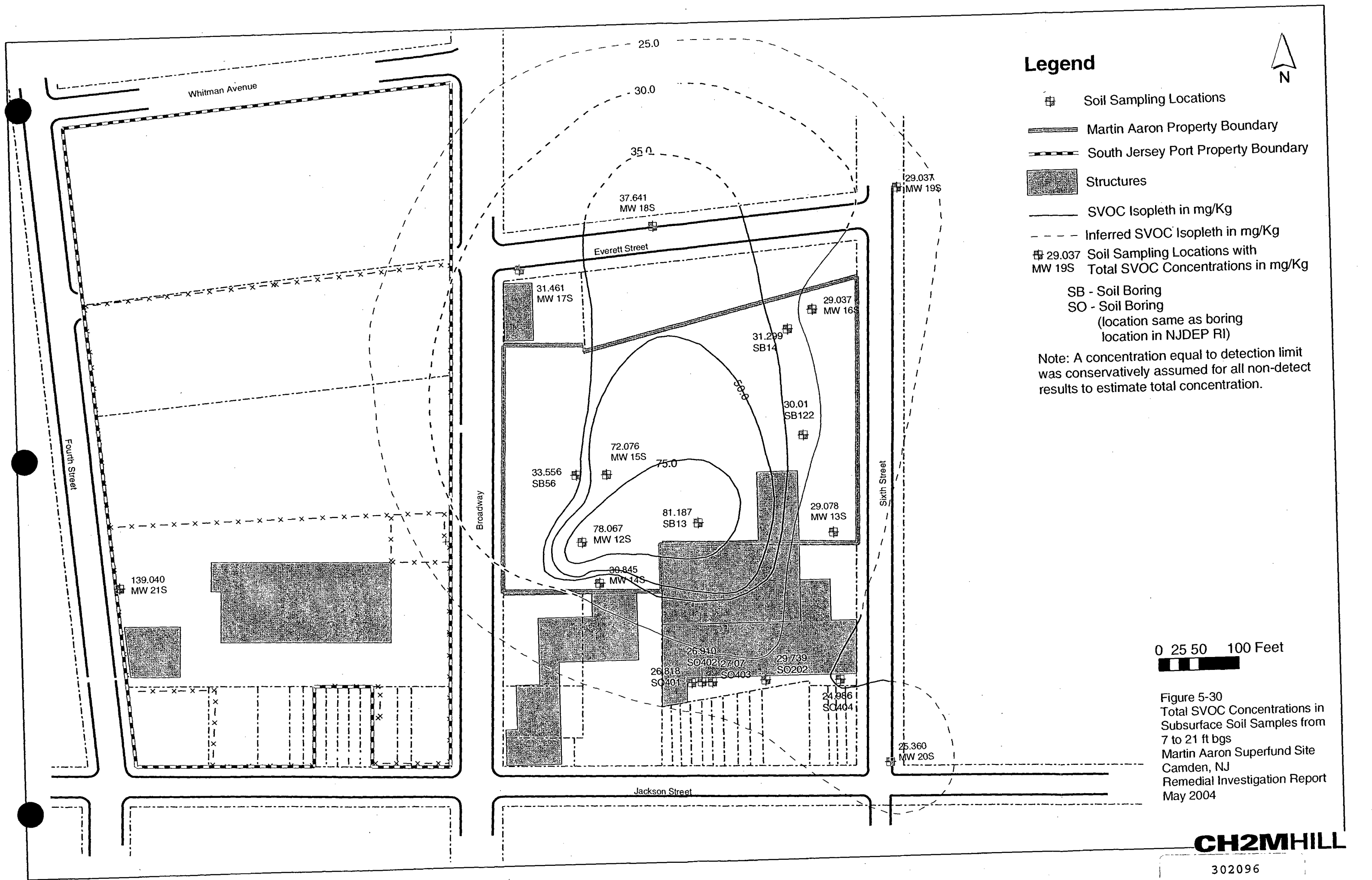
0 25 50 100 Feet


Figure 5-29
Total SVOC Concentrations in
Subsurface Soil Samples
6 to 7 ft bgs
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





Legend

- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- SVOC Isopleth in mg/Kg
- Inferred SVOC Isopleth in mg/Kg
- 29.037 Soil Sampling Locations with MW 19S Total SVOC Concentrations in mg/Kg
- SB - Soil Boring
- SO - Soil Boring (location same as boring location in NJDEP RI)

Note: A concentration equal to detection limit was conservatively assumed for all non-detect results to estimate total concentration.

0 25 50 100 Feet

Figure 5-30
Total SVOC Concentrations in Subsurface Soil Samples from 7 to 21 ft bgs
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

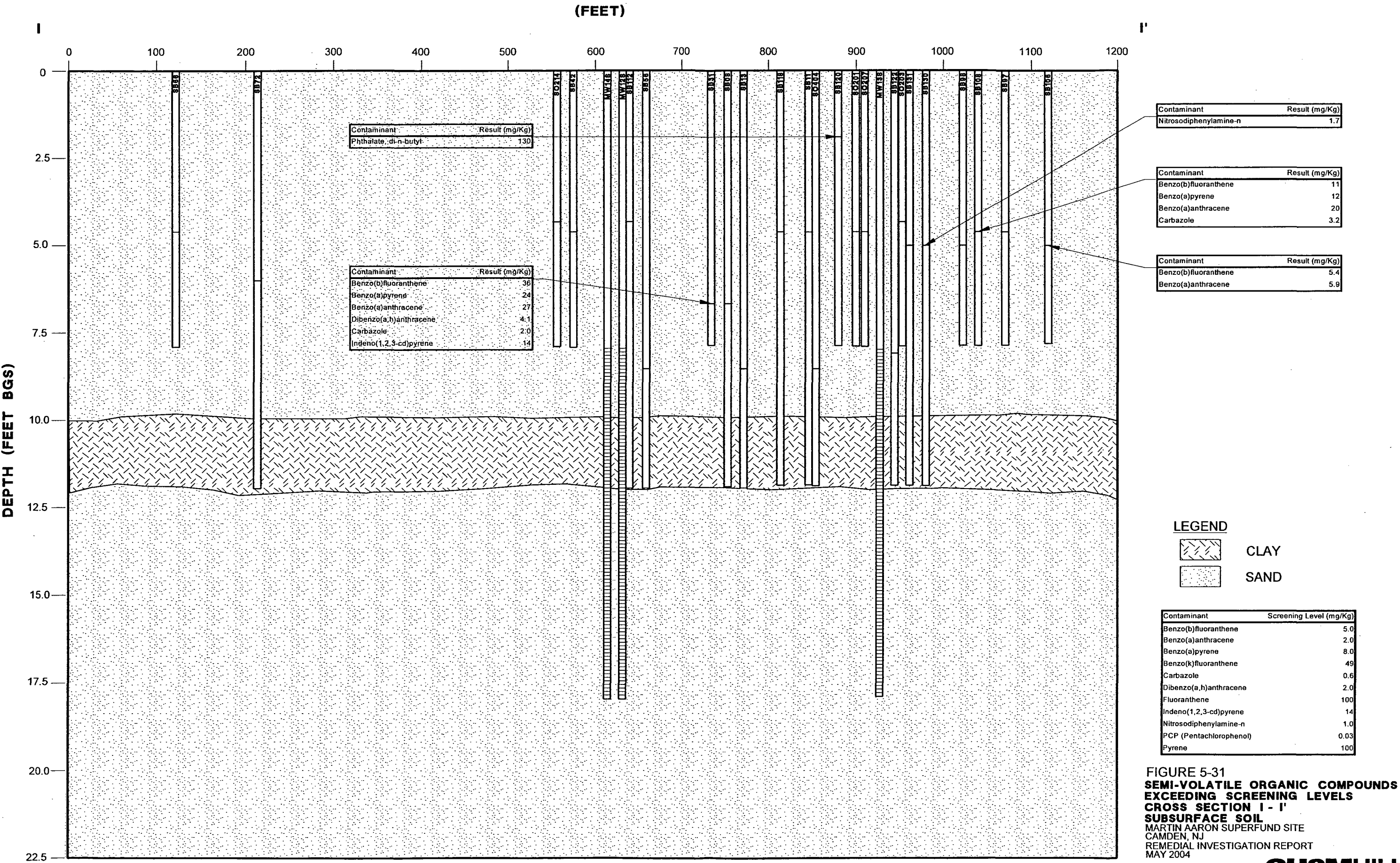


FIGURE 5-31
SEMI-VOLATILE ORGANIC COMPOUNDS
EXCEEDING SCREENING LEVELS
CROSS SECTION I - I'
SUBSURFACE SOIL
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

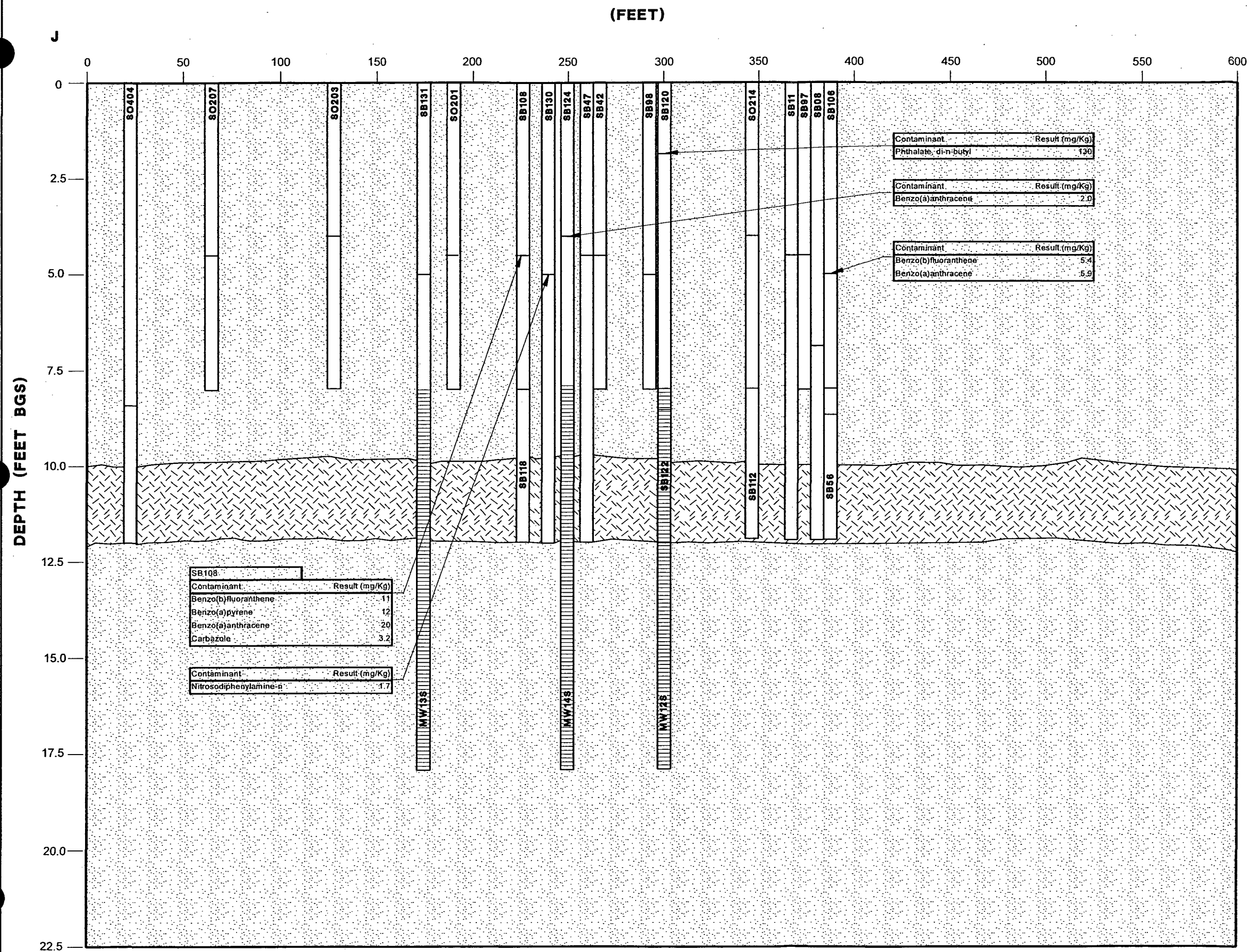
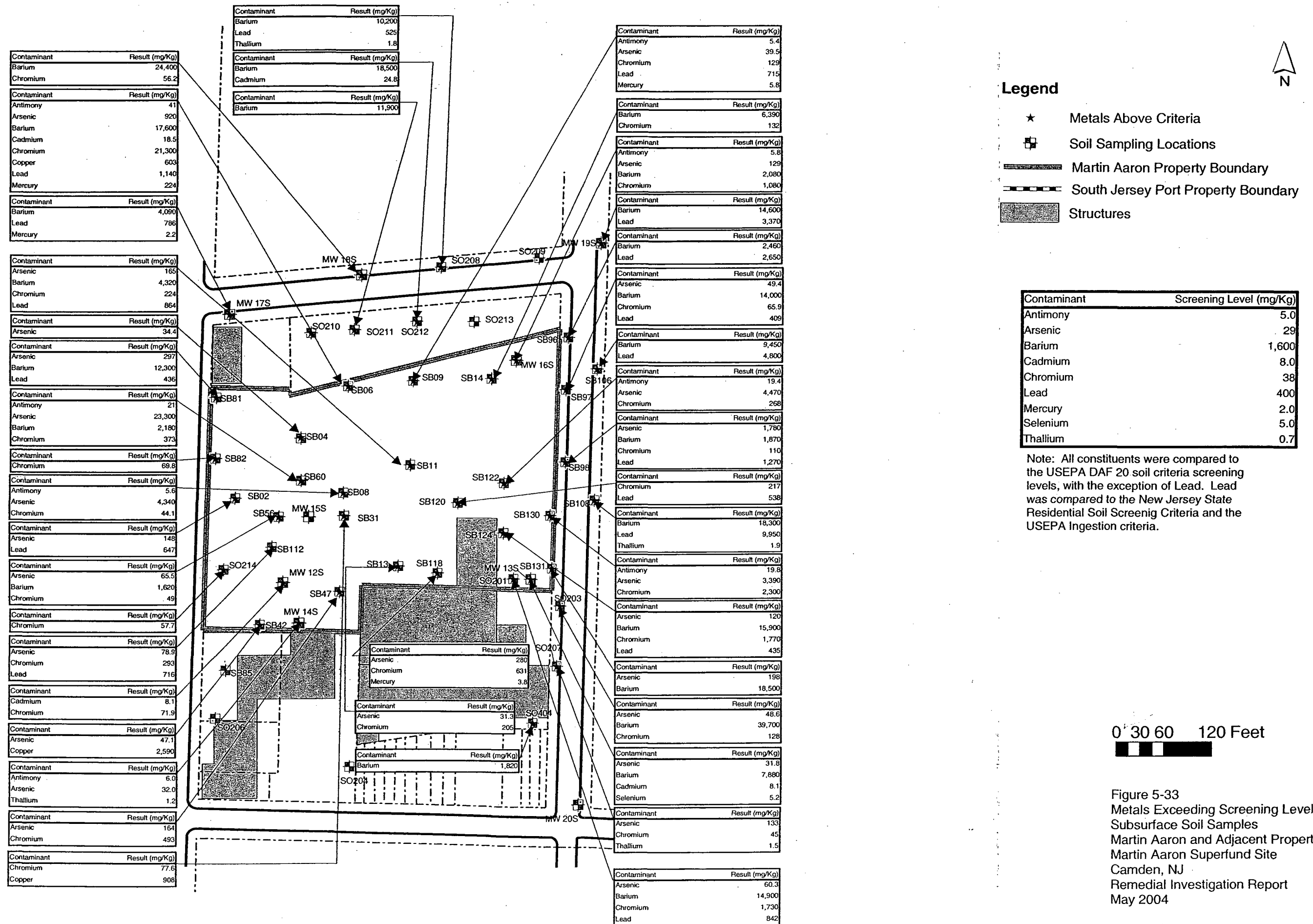
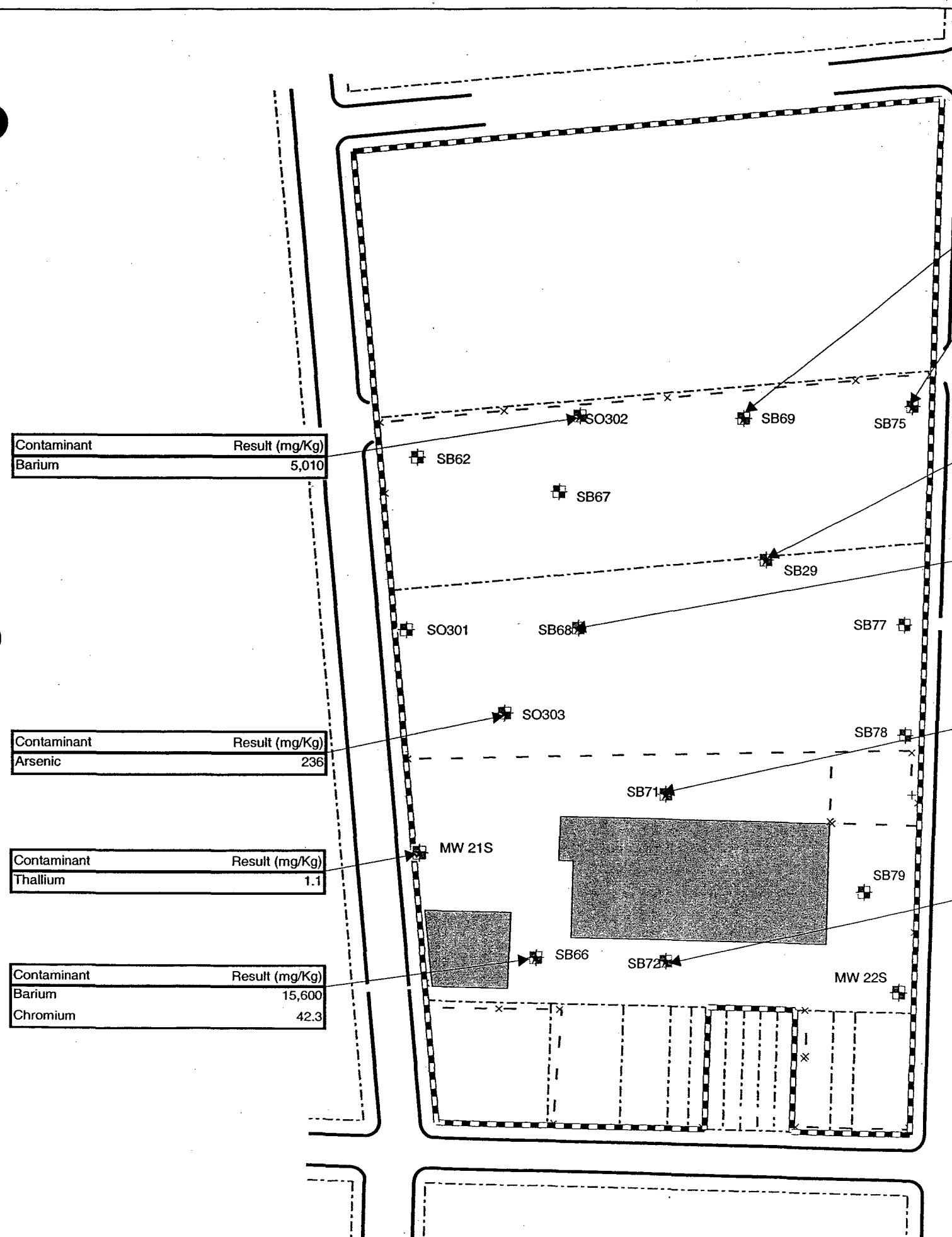


FIGURE 5-32
SEMI-VOLATILE ORGANIC COMPOUNDS
EXCEEDING SCREENING LEVELS
CROSS SECTION J - J'
SUBSURFACE SOIL
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIATION INVESTIGATION REPORT
MAY 2004





Legend

- ★ Metals Above Criteria
- ⊠ Soil Sampling Locations
- ▬ Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- ▒ Structures



Contaminant	Screening Level (mg/Kg)
Antimony	5.0
Arsenic	29
Barium	1,600
Cadmium	8.0
Chromium	38
Lead	400
Thallium	0.7

Note: All constituents were compared to the USEPA DAF 20 soil criteria screening levels, with the exception of Lead. Lead was compared to the New Jersey State Residential Soil Screening Criteria and the USEPA Ingestion Criteria.

0 25 50 100 Feet

Figure 5-34
Metals Exceeding Screening Levels
Subsurface Soil Samples
South Jersey Port Property
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- Soil Sampling Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- Lead Isopleth in mg/Kg
- Inferred Lead Isopleth in mg/Kg
- 339 SB 82 Soil Sampling Locations with Lead Concentrations in mg/Kg

SB - Soil Boring
SO - Soil Boring
(location same as boring location in NJDEP RI)

ND - Not detected
J - Estimated in quantity

Soil Screening Criteria

EPA - 400 mg/Kg
NRDCSCC - 600 mg/Kg
IGWSCC - NA

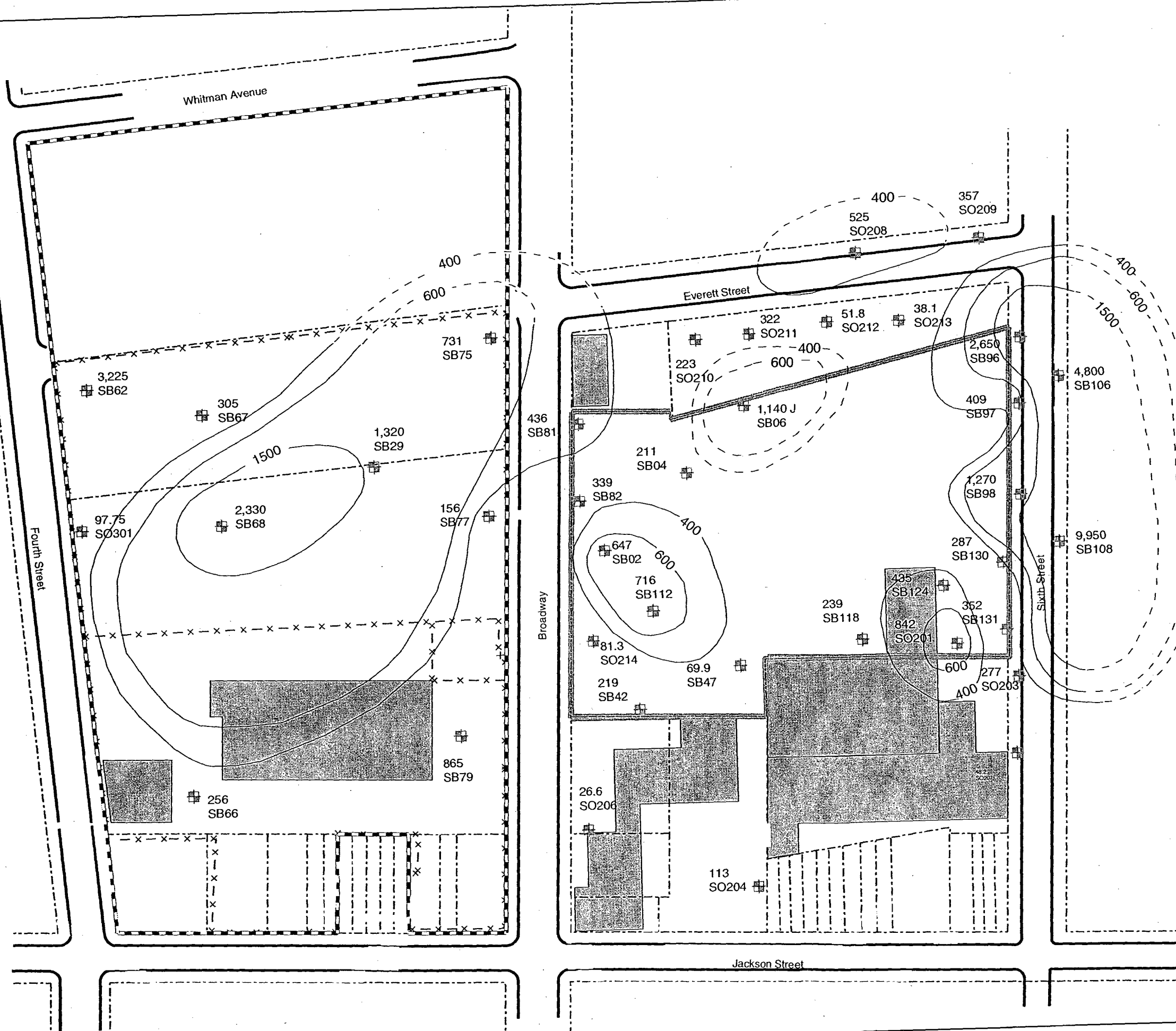
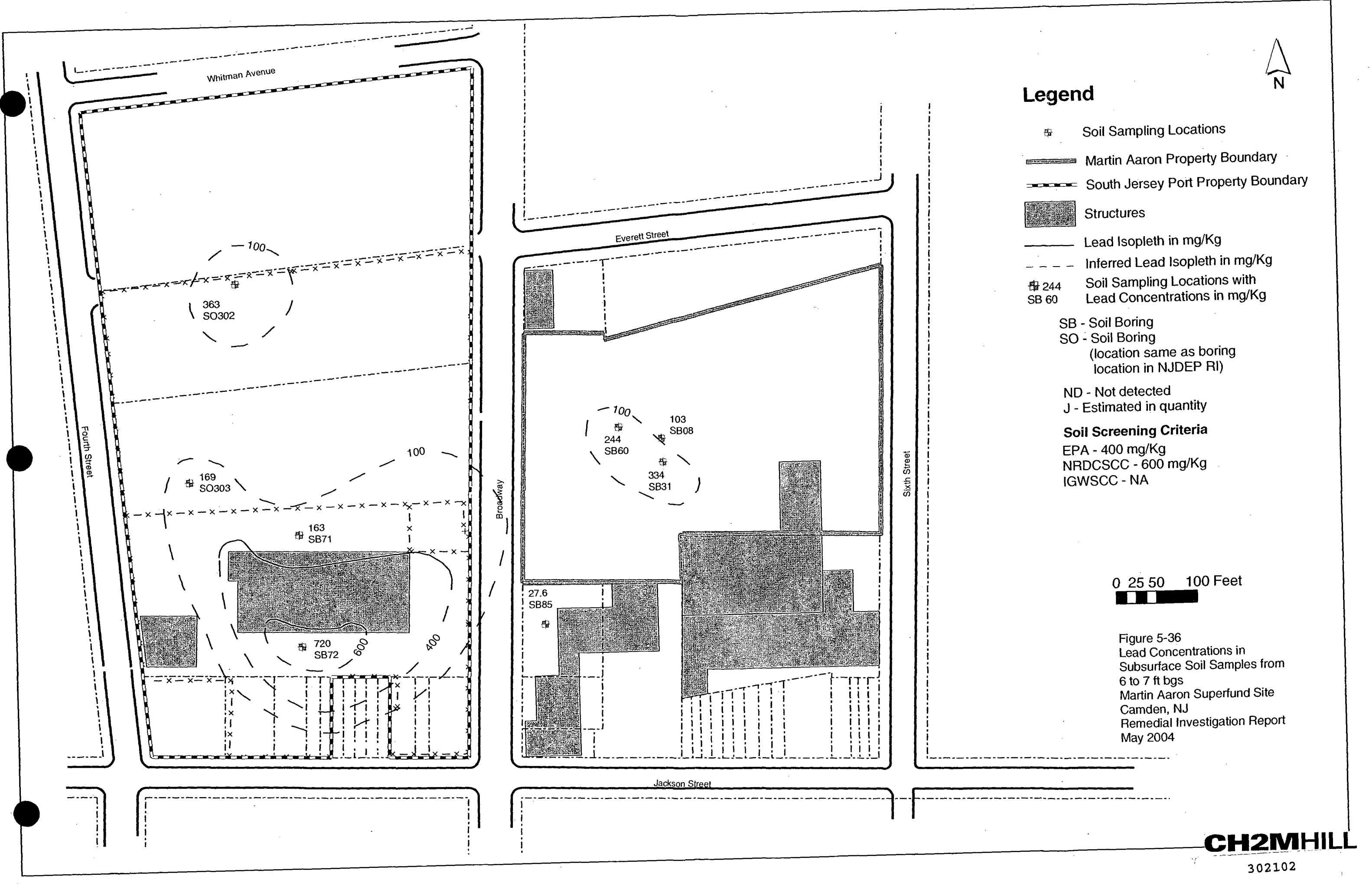
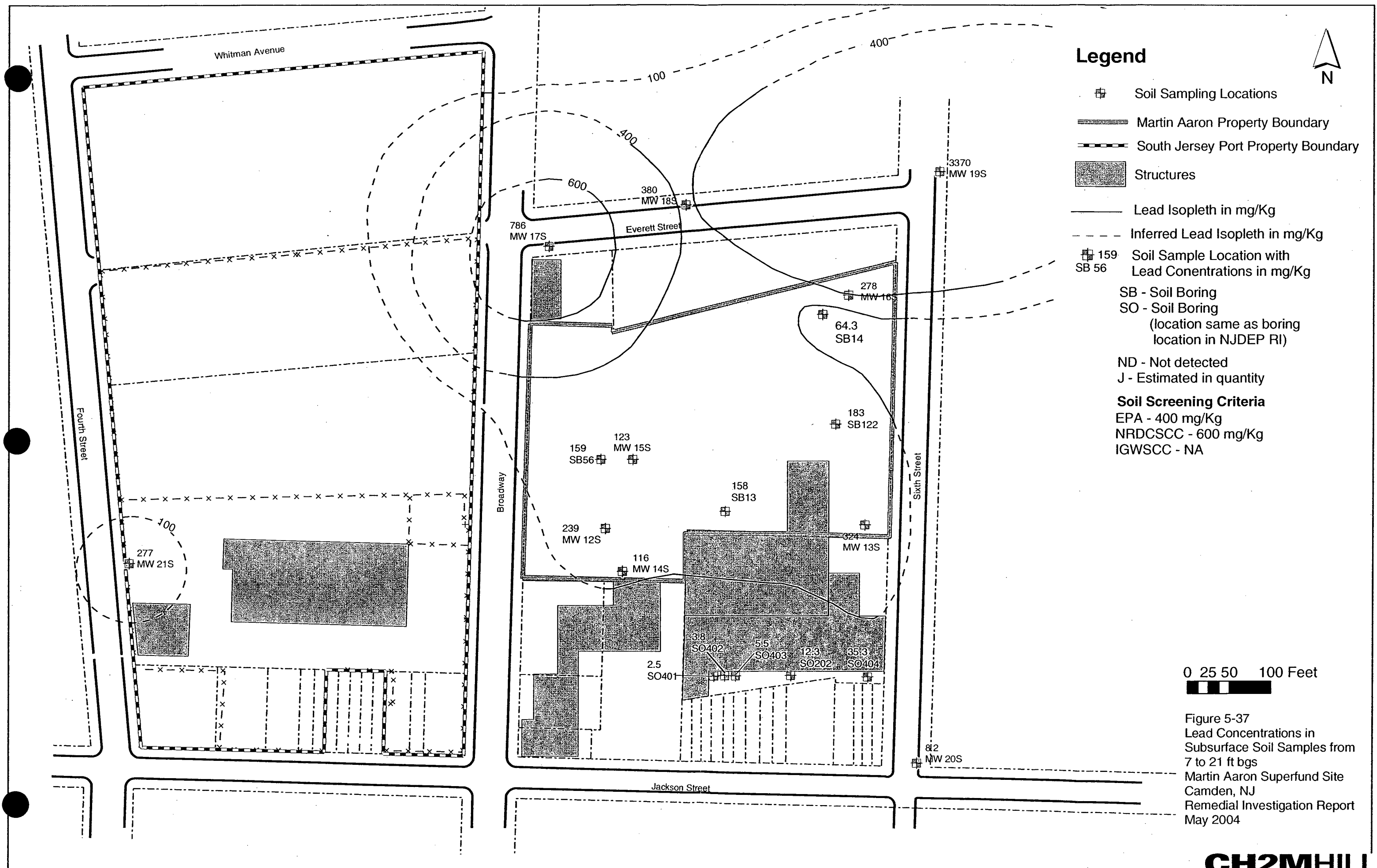


Figure 5-35
Lead Concentrations in
Subsurface Soil Samples from
4 to 5 ft bgs
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





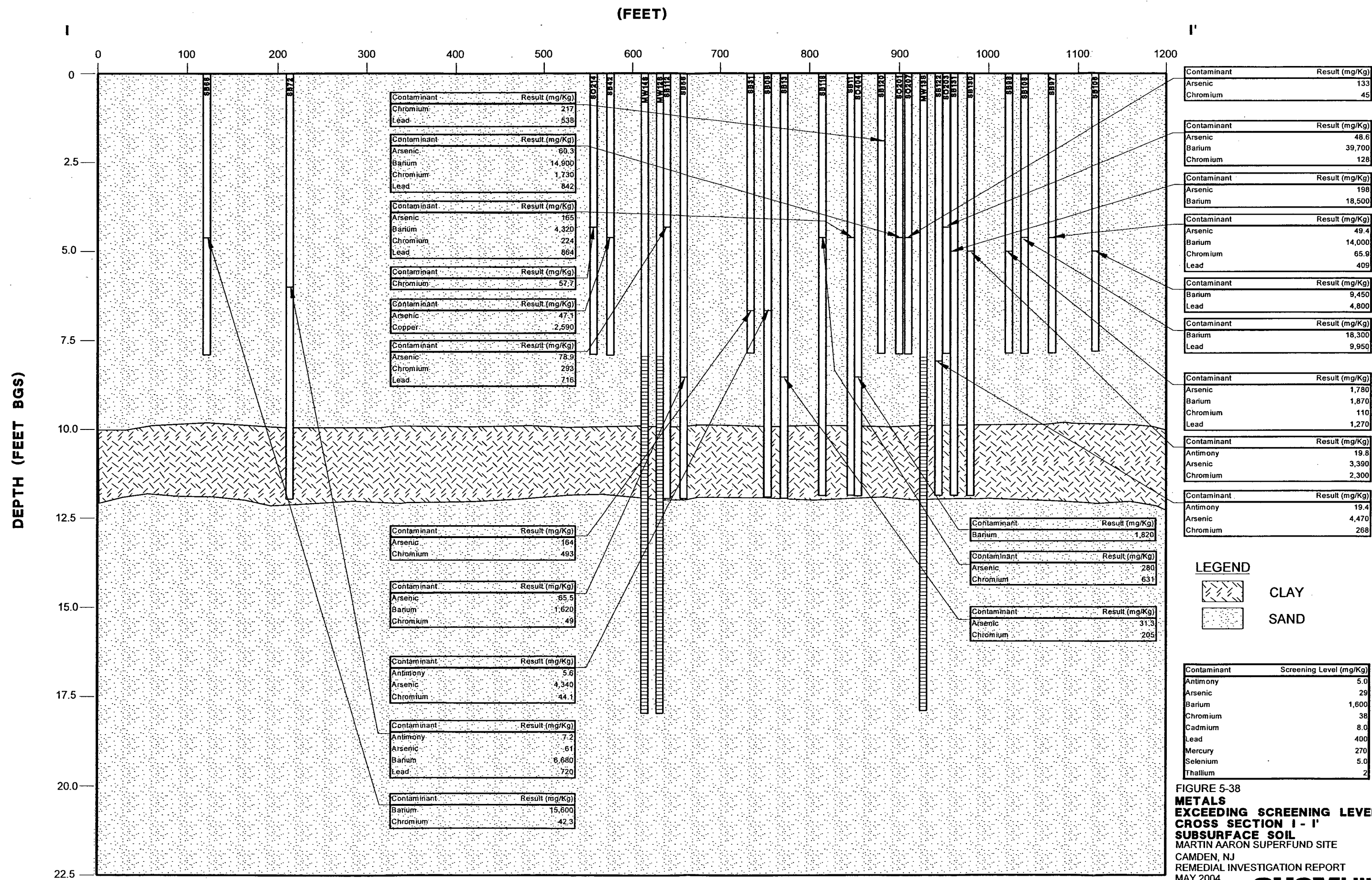
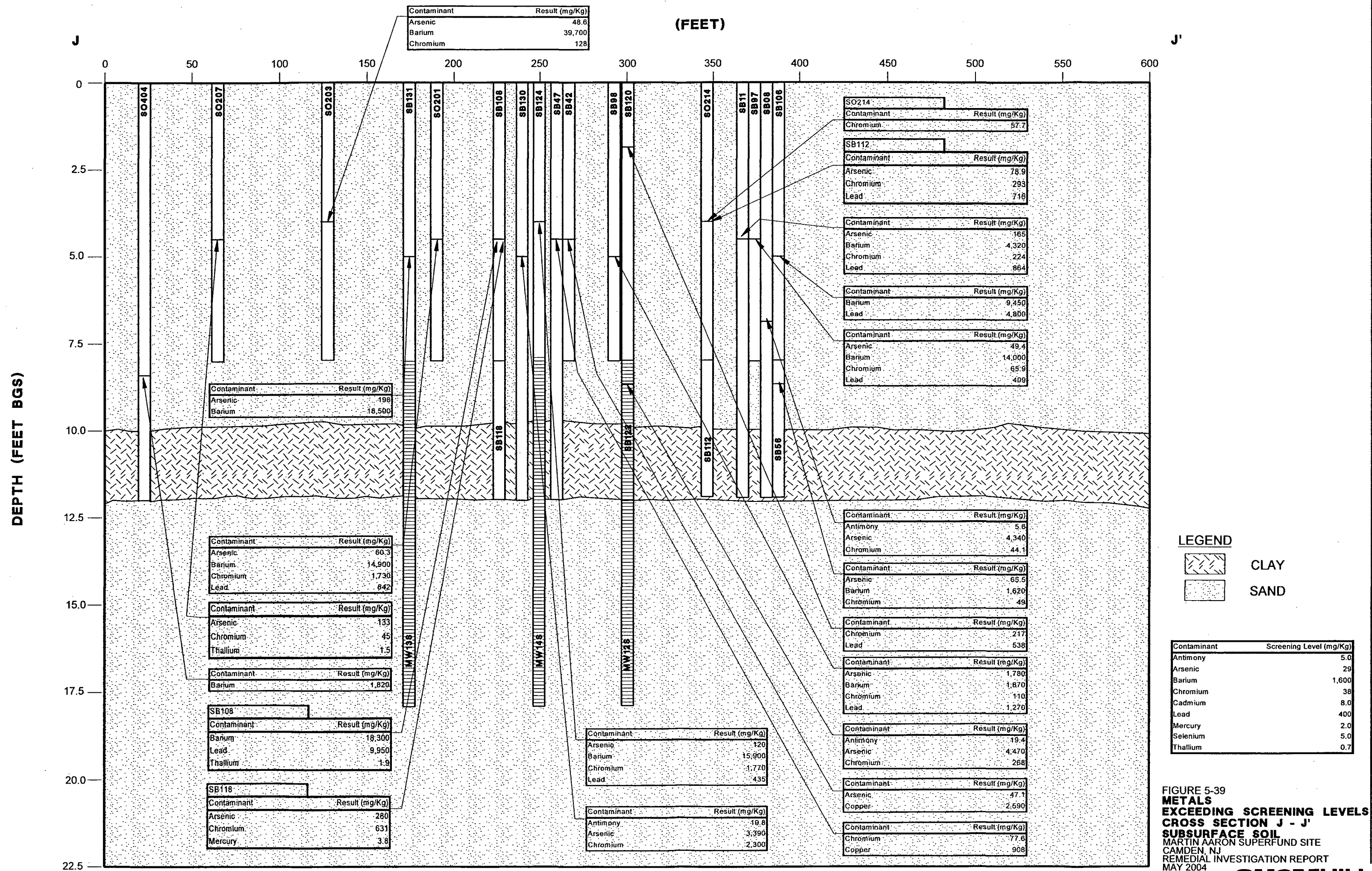


FIGURE 5-38
METALS EXCEEDING SCREENING LEVELS
CROSS SECTION I - I'
SUBSURFACE SOIL
 MARTIN AARON SUPERFUND SITE
 CAMDEN, NJ
 REMEDIAL INVESTIGATION REPORT
 MAY 2004



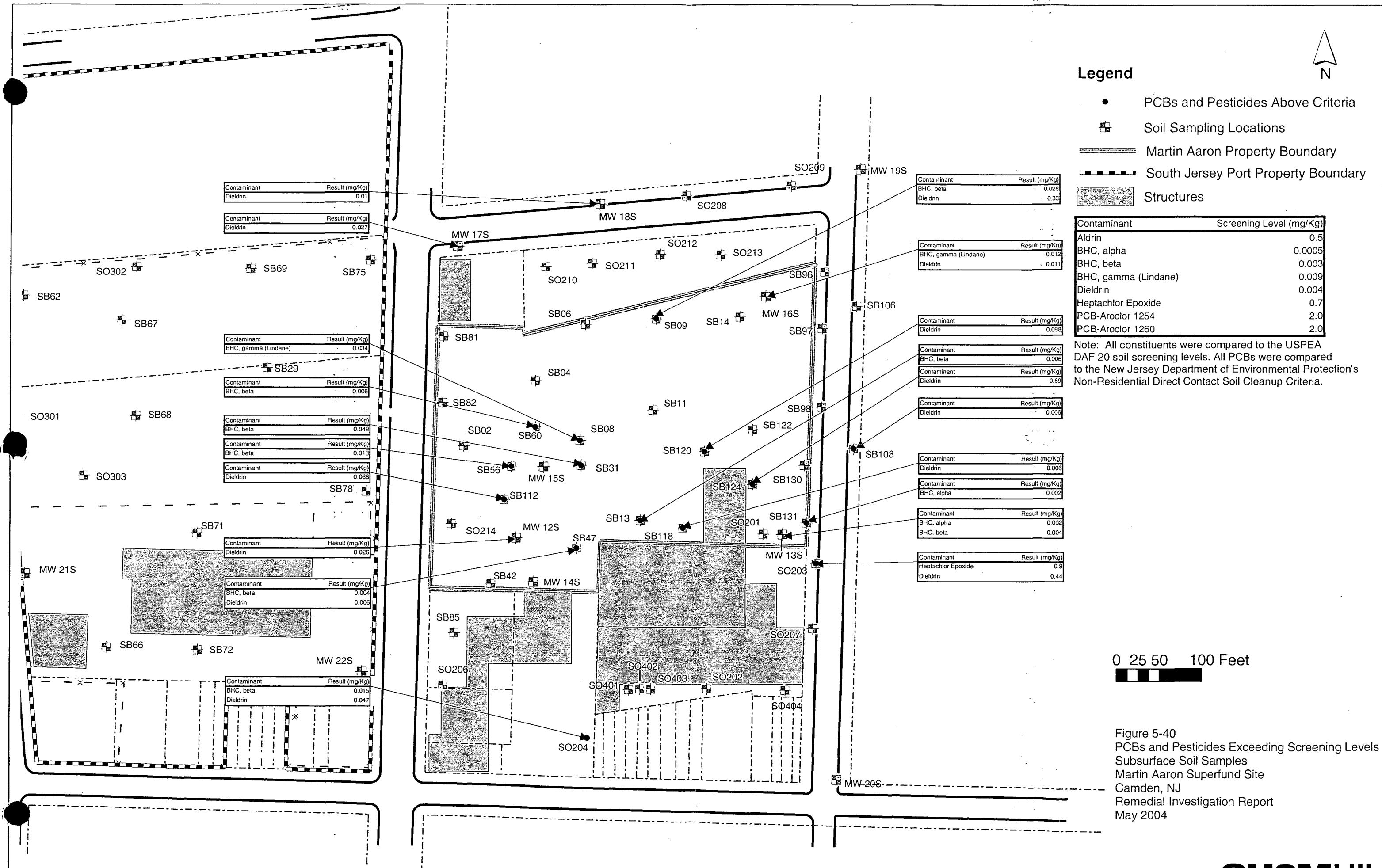
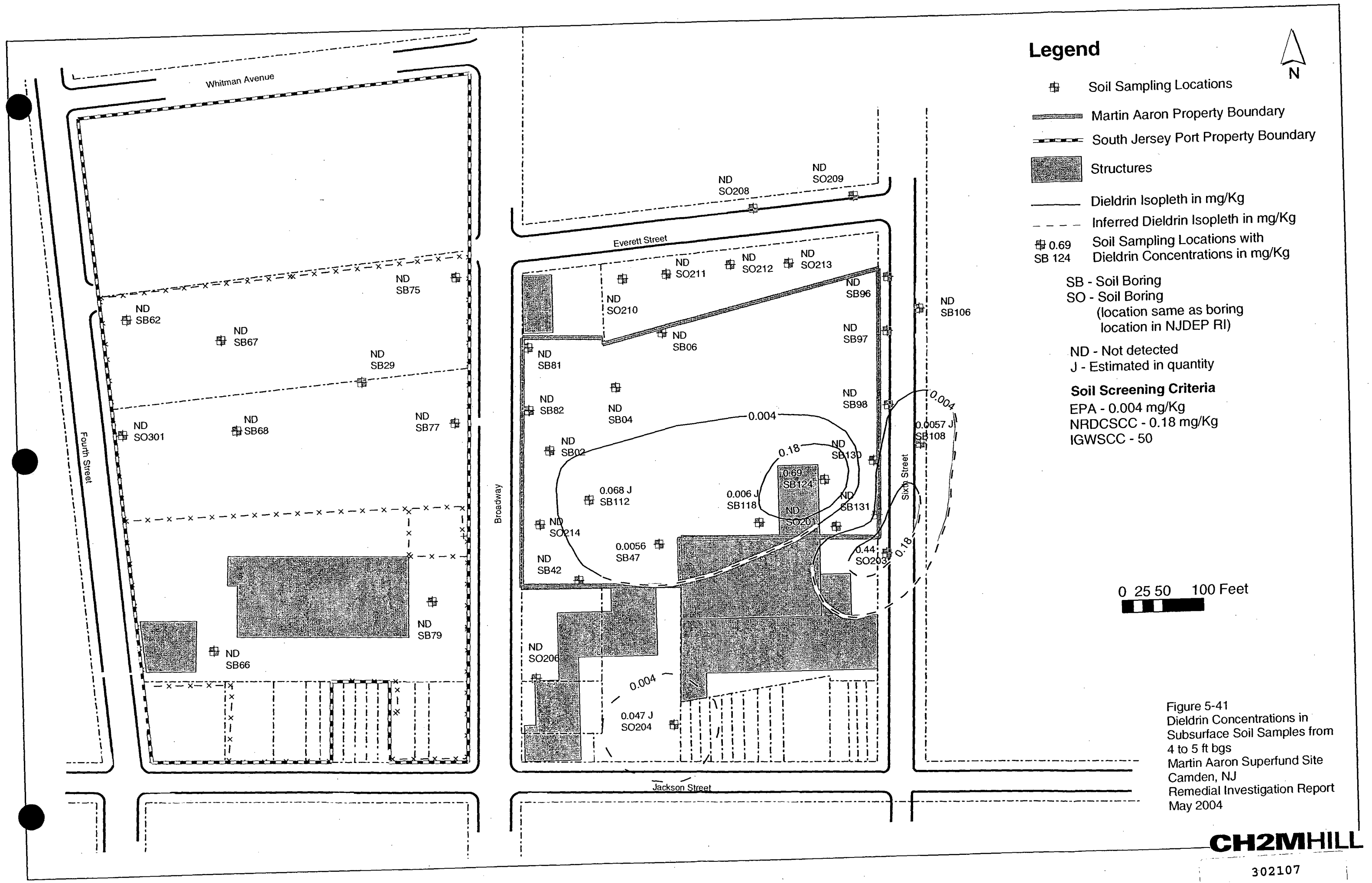
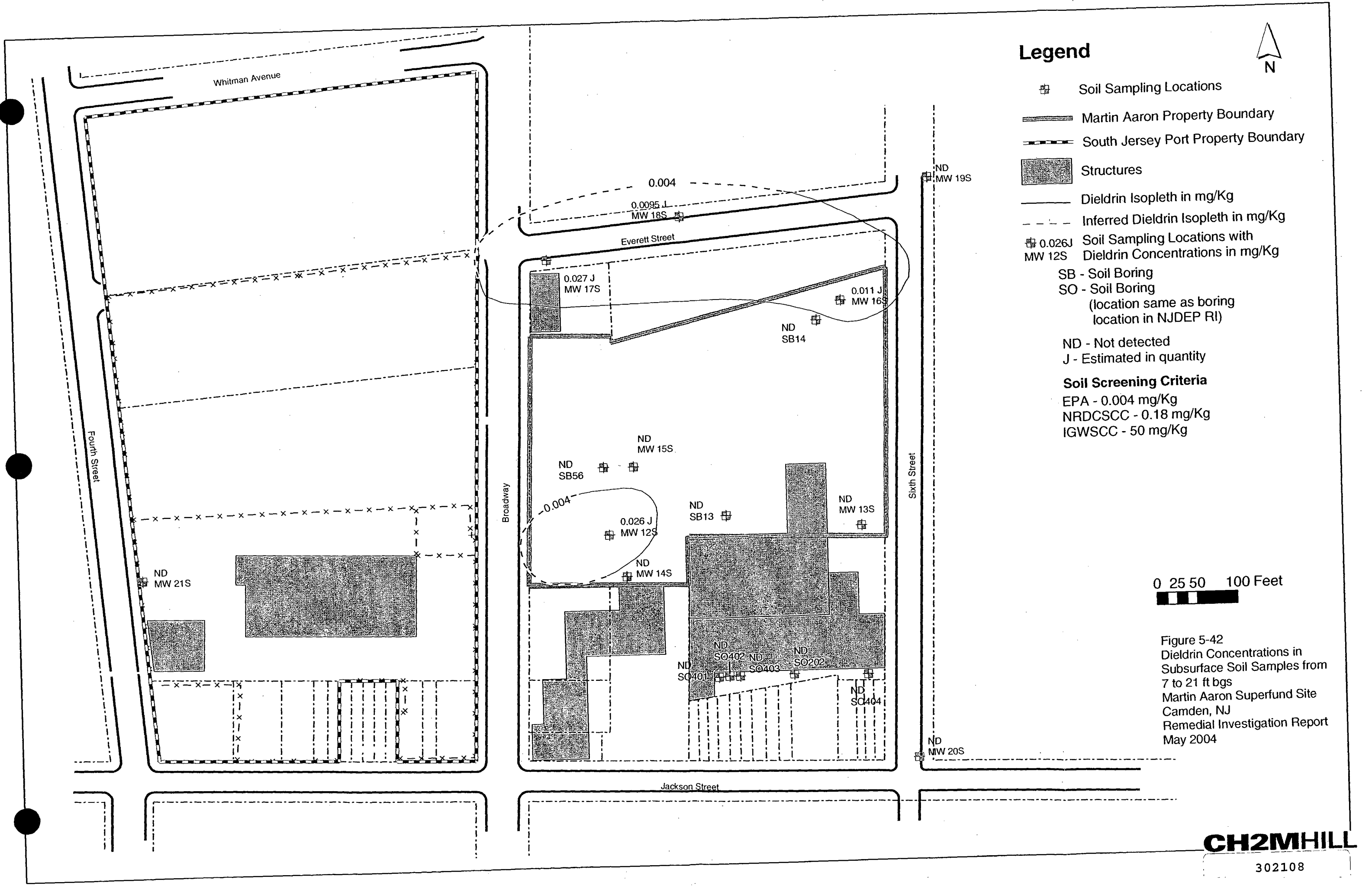


Figure 5-40
PCBs and Pesticides Exceeding Screening Levels
Subsurface Soil Samples
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





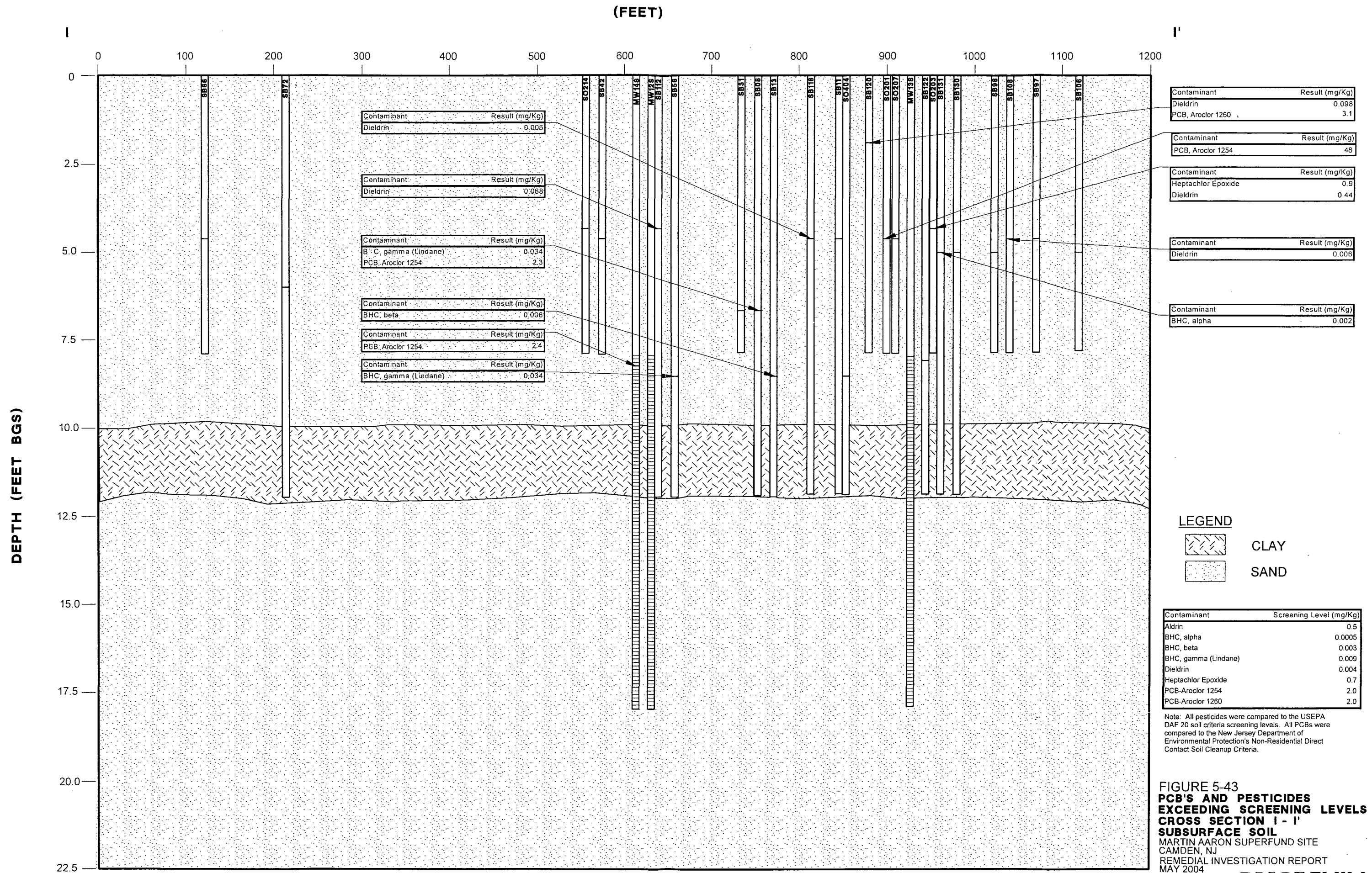


FIGURE 5-43
**PCB'S AND PESTICIDES
 EXCEEDING SCREENING LEVELS
 CROSS SECTION I - I'**
 SUBSURFACE SOIL
 MARTIN AARON SUPERFUND SITE
 CAMDEN, NJ
 REMEDIAL INVESTIGATION REPORT
 MAY 2004

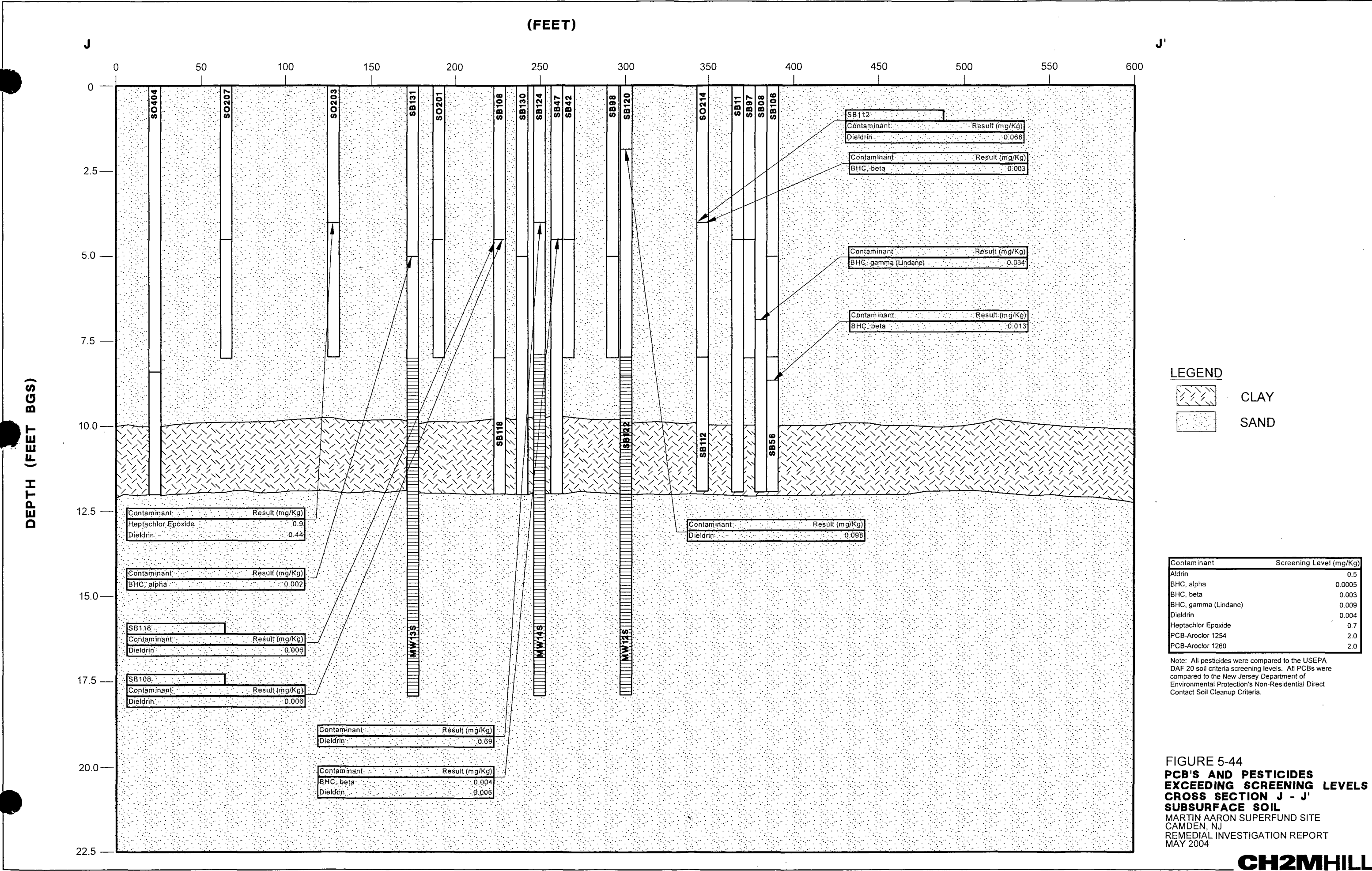


FIGURE 5-44
PCB'S AND PESTICIDES
EXCEEDING SCREENING LEVELS
CROSS SECTION J - J'
SUBSURFACE SOIL
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004



Legend

- * Volatile Organic Compounds Above Criteria
- ⊙ Existing Monitoring Well Locations
- ⊕ New Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- Structures

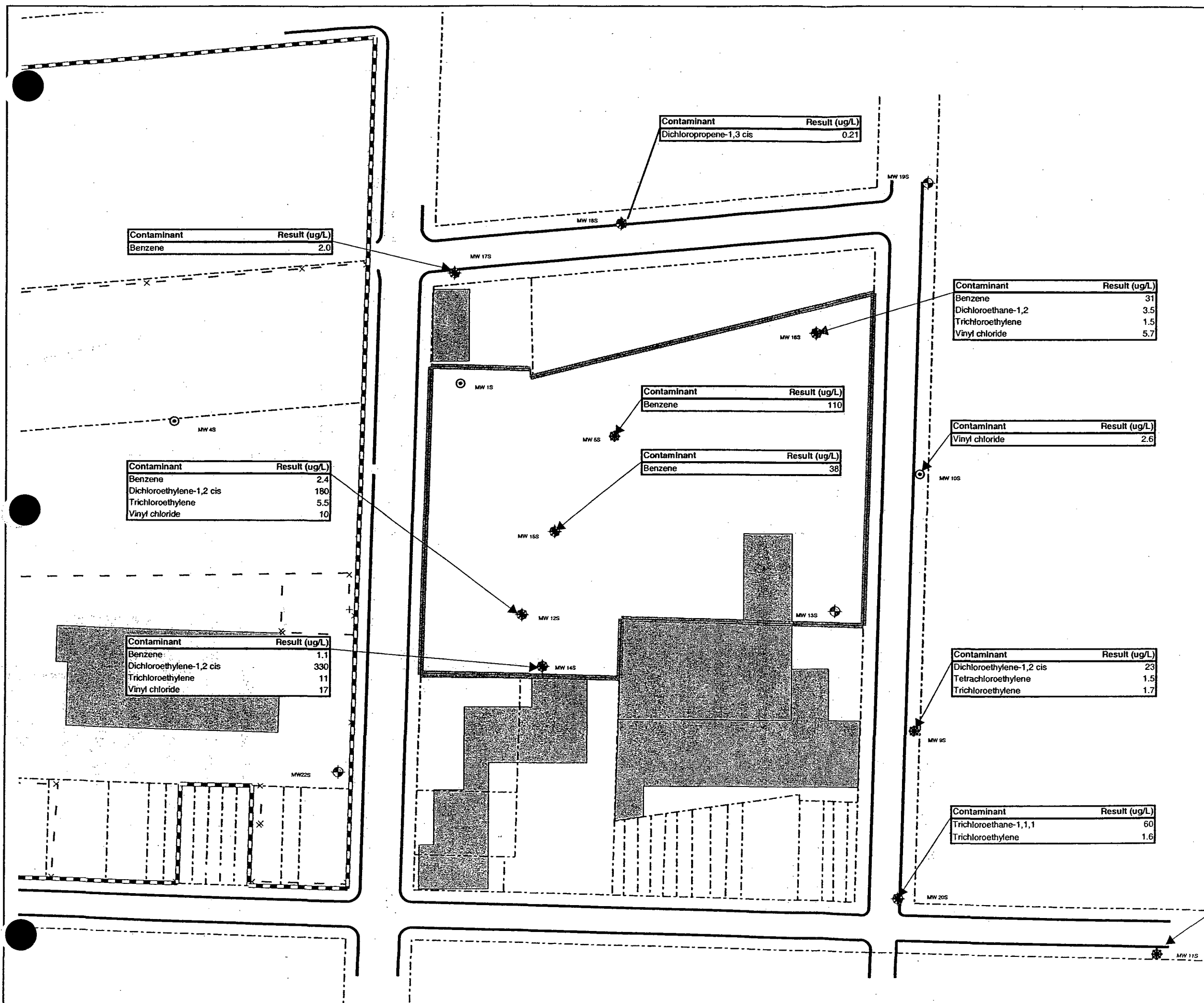
Contaminant	Screening Level (ug/L)
Benzene	1.0
Dichloroethylene-1,2 cis	10
Dichloropropene-1,3 cis	0.02
Trichloroethane-1,1,1	30
Trichloroethylene	1.0
Vinyl chloride	2.0

Note: All compounds were compared the New Jersey Department of Environmental Protection's groundwater quality criteria NJGWQC), with the exception of Vinyl Chloride. Vinyl Chloride was compared to the USEPA MCL.

0 25 50 100 Feet



Figure 5-45
Volatile Organic Compounds In Groundwater
Surficial Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





Legend

- ▲ Semivolatiles Above Criteria
- ⊙ Existing Monitoring Well Locations
- ⊕ New Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- Structures

Contaminant	Screening Level (ug/L)
Ether, bis(2-chloroethyl)	10
Nitrosodiphenylamine-n	20

Note: All compounds were compared to the New Jersey Department of Environmental Protection's groundwater quality criteria (NJGWQC) screening levels.

Contaminant	Result (ug/L)
Ether, bis(2-chloroethyl)	15

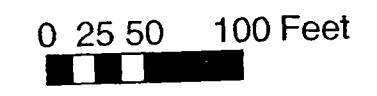
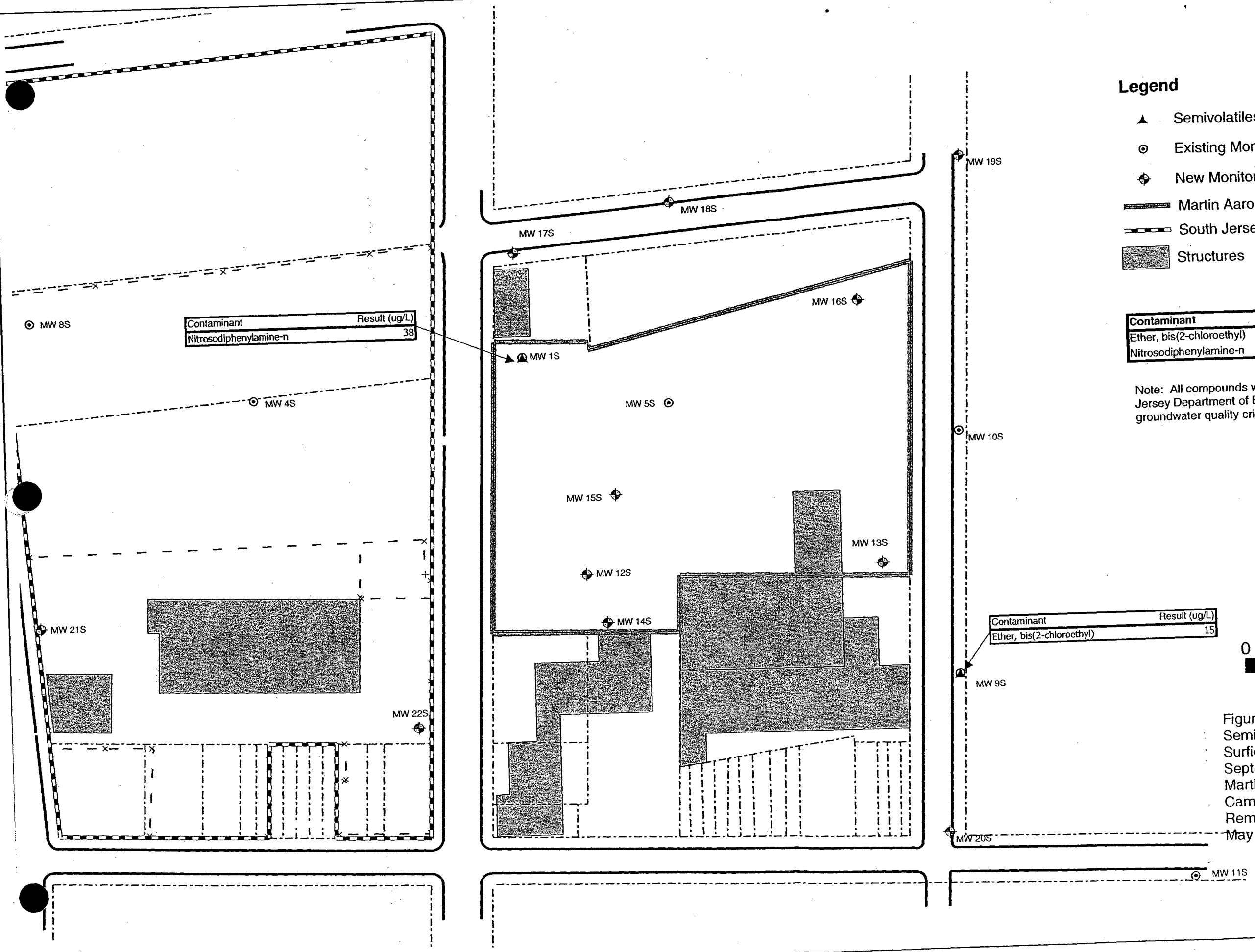


Figure 5-46
Semivolatile Organic Compounds In Groundwater
Surficial Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





Legend

- ✱ Metals Above Criteria
- ⊙ Existing Monitoring Well Locations
- ⊕ New Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- ▒ Structures

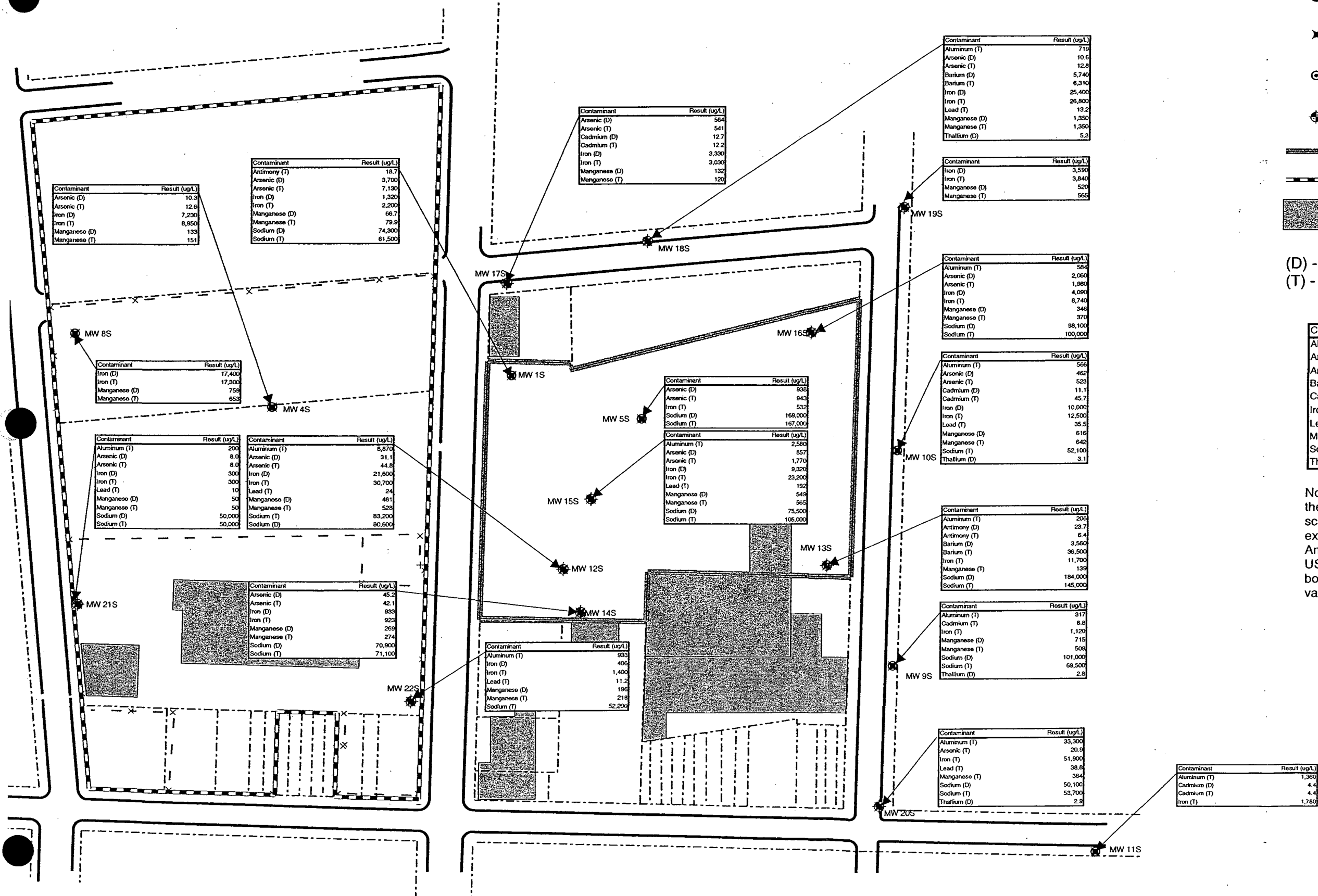
(D) - Dissolved Metals Sample
(T) - Total Metals Sample

Contaminant	Screening Level (ug/L)
Aluminum	200
Antimony	6.0
Arsenic	8.0
Barium	2,000
Cadmium	4.0
Iron	300
Lead	10
Manganese	50
Sodium	50,000
Thallium	2.0

Note: All constituents were compared to the New Jersey State impact to groundwater screening criteria (NJGWQC), with the exception of Antimony, Barium, and Thallium. Antimony and Thallium were compared to the USEPA MCL, and Barium was compared to both sets of standards because the values were equal.

0 30 60 120 Feet

Figure 5-47
Metals In Groundwater
Surficial Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





Legend

- ★ Pesticides and PCBs Above Criteria
- ⊙ Existing Monitoring Well Locations
- ⊕ New Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- Structures

Contaminant	Screening Level (ug/L)
Dieldrin	0.03

Note: All compounds were compared to the New Jersey state groundwater quality criteria (NJGWQC) screening levels.

Contaminant	Result (ug/L)
Dieldrin	0.032

Contaminant	Result (ug/L)
Dieldrin	0.099

Contaminant	Result (ug/L)
Dieldrin	0.057

0 25 50 100 Feet



Figure 5-48
PCBs and Pesticides In Groundwater
Surficial Upper PRM Aquifer
June 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

- * Volatile Organic Compounds Above Criteria
- ⬤ New Monitoring Well Locations
- ⊙ Existing Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- ▒ Structures

Contaminant	Screening Level (ug/L)
Benzene	1.0
Dichloroethylene-1,2 cis	10
Dichloropropane-1,2	1.0
Dichloropropene-1,3 cis	0.02
Trichloroethylene	1.0
Vinyl chloride	2.0

Note: All constituents were compared to the USEPA MCL, with the exception of Vinyl Chloride. Vinyl Chloride was compared the New Jersey Department of Environmental Protection's (NJGWC) groundwater screening criteria.

0 25 50 100 Feet

Figure 5-49
Volatile Organic Compounds In Groundwater
Middle Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
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Contaminant	Result (ug/L)
Benzene	8.3

Contaminant	Result (ug/L)
Dichloropropane-1,2	1.7

Contaminant	Result (ug/L)
Dichloroethylene-1,2 cis	37
Vinyl chloride	17

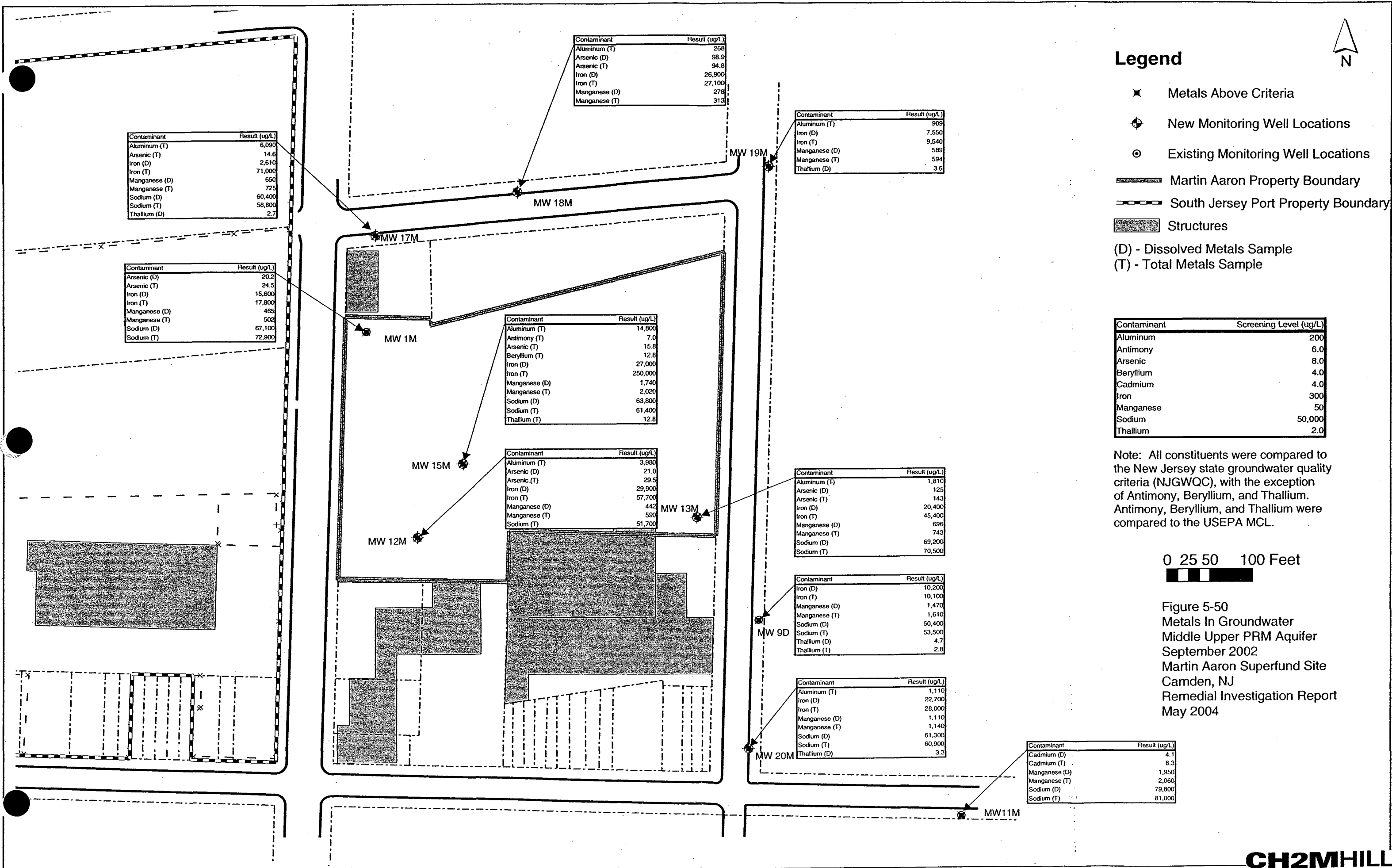
Contaminant	Result (ug/L)
Dichloroethylene-1,2 cis	14
Vinyl chloride	2.4

Contaminant	Result (ug/L)
Benzene	2.6

Contaminant	Result (ug/L)
Trichloroethylene	1.3
Dichloropropene-1,3 cis	0.2

Contaminant	Result (ug/L)
Vinyl chloride	4.2

Contaminant	Result (ug/L)
Dichloropropane-1,2	1.7





Legend

- * Volatile Organic Compounds Above Criteria
- ⊕ New Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- ▒ Structures

Contaminant	Result (ug/L)
Vinyl chloride	2.4

Contaminant	Screening Level (ug/L)
Trichloroethylene	1.0
Vinyl chloride	2.0

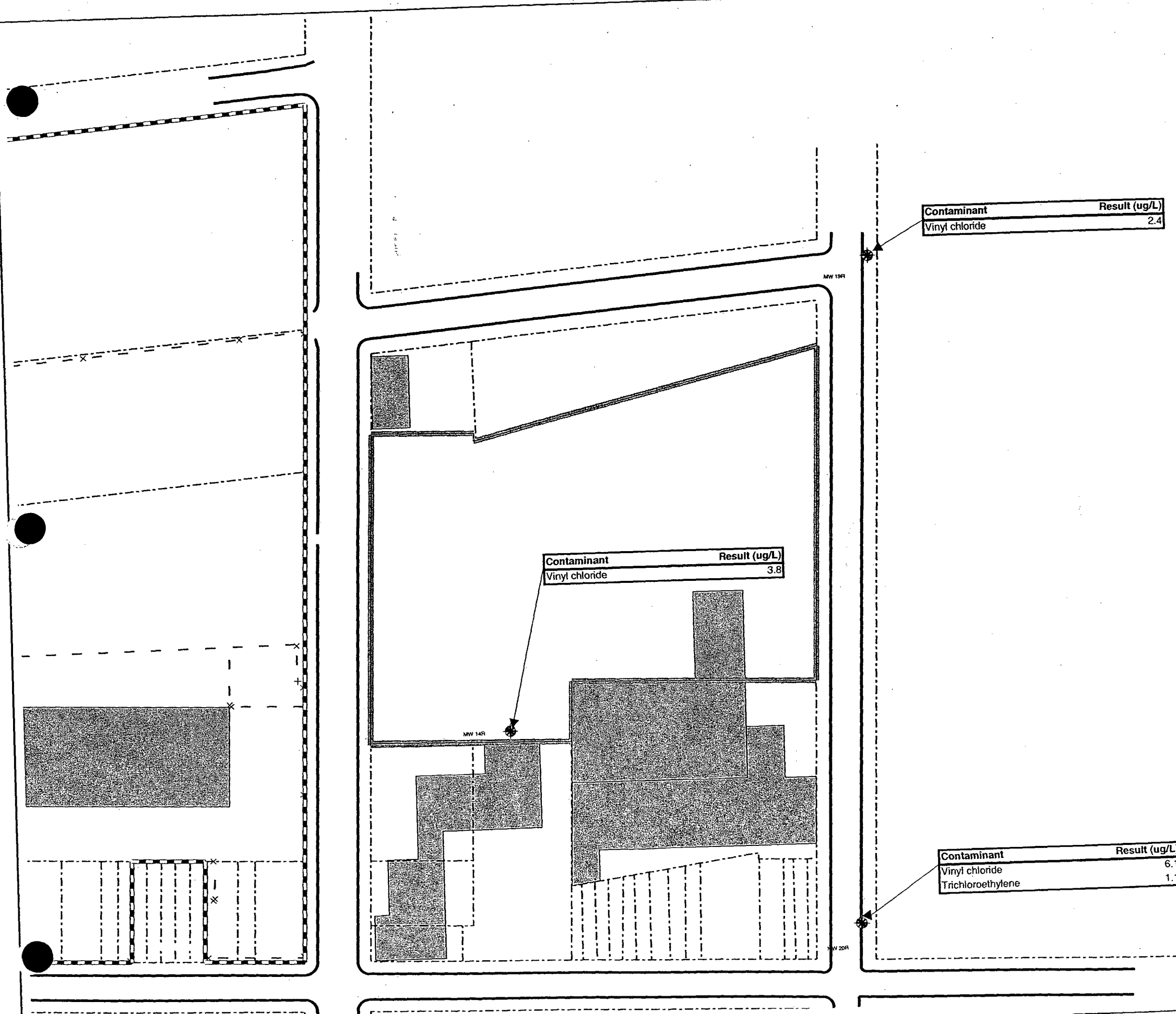
Note: TCE was compared to the New Jersey Department of Environmental Protection's (NJGWQC) groundwater screening criteria, and Vinyl Chloride was compared to the USEPA MCL.

0 25 50 100 Feet

Figure 5-51
Volatile Organic Compounds In Groundwater
Basal Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Contaminant	Result (ug/L)
Vinyl chloride	6.1
Trichloroethylene	1.1

Contaminant	Result (ug/L)
Vinyl chloride	3.8





Legend

- ✱ Metals Above Criteria
 - ⊙ New Monitoring Well Locations
 - Martin Aaron Property Boundary
 - - - South Jersey Port Property Boundary
 - Structures
- (D) - Dissolved Metals Sample
(T) - Total Metals Sample

Contaminant	Result (ug/L)
Aluminum (D)	206
Aluminum (T)	453
Iron (D)	80,500
Iron (T)	80,200
Manganese (D)	4,540
Manganese (T)	4,490
Sodium (D)	3,060,000
Sodium (T)	3,010,000
Thallium (D)	12.9
Thallium (T)	12.5

Contaminant	Screening Level (ug/L)
Aluminum	200
Beryllium	4.0
Iron	300
Manganese	50
Sodium	50,000
Thallium	2.0

Note: All constituents were compared to the New Jersey state groundwater quality criteria screening levels (NJGWQC), with the exception of Beryllium and Thallium. Beryllium and Thallium were compared to the USEPA MCL.

0 25 50 100 Feet

Figure 5-52
Metals In Groundwater
Basal Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

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Contaminant	Result (ug/L)
Aluminum (T)	503
Iron (D)	13,100
Iron (T)	14,600
Manganese (D)	2,130
Manganese (T)	2,290
Sodium (D)	76,100
Sodium (T)	78,900
Thallium (D)	2.6
Thallium (T)	2.7

Contaminant	Result (ug/L)
Aluminum (D)	531
Aluminum (T)	1,080
Beryllium (D)	5.0
Iron (D)	133,000
Iron (T)	106,000
Manganese (D)	2,960
Manganese (T)	2,470
Sodium (D)	632,000
Sodium (T)	456,000
Thallium (D)	8.8
Thallium (T)	7.8



Legend

- ✱ Metals Above Criteria
- ⊕ New Monitoring Well Locations
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- Structures

(D) - Dissolved Metals Sample
(T) - Total Metals Sample

Contaminant	Screening Level (ug/L)
Aluminum	200
Iron	300
Lead	10
Manganese	50
Sodium	50,000
Thallium	2.0

Note: All constituents were compared to the New Jersey state groundwater quality criteria screening levels (NJGWQC), with the exception of Thallium. Thallium was compared to the USEPA MCL.

0 25 50 100 Feet

Figure 5-53
Metals In Groundwater
Upper Middle PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Contaminant	Result (ug/L)
Aluminum (T)	3,670
Iron (T)	8,300
Lead (T)	16.6
Manganese (D)	415
Manganese (T)	598

MW 18D

Contaminant	Result (ug/L)
Aluminum (T)	772
Iron (D)	2,320
Iron (T)	3,660
Manganese (D)	198
Manganese (T)	214

MW 14D

6. Contaminant Fate and Transport

Through evaluation of data collected during investigation efforts of potential contaminant sources at the Site including the Martin Aaron property and the surrounding areas, an understanding was developed regarding the interaction between the historic waste-management practices on the property, the hydrogeologic setting, and transformation (fate) and movement (transport) of constituents within that setting.

Fundamental to describing fate and transport at the Site is the understanding of natural attenuation processes that reduce contaminant mass and retard the migration of contaminants. These processes along with the characterization of contaminant sources, release mechanisms, rates of migration and attenuation, persistence of contaminants, and migration pathways for contaminants are discussed in this section.

COCs in the soil and groundwater at the Site consist of a variety of VOCs including aromatic hydrocarbons (including the BTEX compounds), chlorinated aliphatic hydrocarbons (CAHs), and assorted polyaromatic hydrocarbons (PAHs). The primary COCs are TCE, PCE and related CAHs. These related CAHs include cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, vinyl chloride, and chloroethane. Subsequently, the discussion of the fate and transport of chemicals in the subsurface has focused on the CAH and BTEX compounds in groundwater at the Site.

6.1 Potential Routes of Migration

As discussed in Section 2.3 and presented in Figure 2-1, various historical waste management activities in locations at the Martin Aaron property introduced contaminants into the immediate environment. These sources for soil, and ultimately groundwater, contamination include:

- **Buried Wastes:** Buried drums containing hazardous waste and soils contaminated with hazardous substances were observed in test pits at Martin Aaron and were excavated to depths below the local groundwater table.
- **Roll-Off Containers and Drums:** Roll-off containers used for storage of hazardous waste had leaked onto soils at the property, drums stored within the yard area were observed to contain holes and/or were stored upside down allowing contents to leak onto the ground, and two tractor trailers containing 100 drums each (and vapor presence) were staged along side the facility.
- **Sewer Basins/Floor Drains:** Basins 1,2, and 3 collected effluent from the former Martin Aaron Building. Dye testing of sewer basins 2 and 3 in the southwest portion of the property failed to locate any outfall structure. Effluent from the former Wadco/Martin Aaron operations was discharged directly to the subsurface by infiltration, and the discharge pipe located in the influent side of Basin 1 was observed to allow untreated effluent to discharge. Basin 4 was located east of the Rhodes Drum Building and was

verified, using dye testing, to have received influent from the floor drains of the Rhodes Drum Building.

- **Storage Tanks:** Seven ASTs were located in the process area outside the north wall of the Rhodes Drum Building. The metals tanks were severely corroded. Fill pipes leading to three USTs were located near the former Martin Aaron Building. Discharges to surface runoff, soils, and groundwater were suspected from the storage tanks and their appurtenances.
- **Building Operations:** Contaminants, paint residues, and wastewater may have been discharged to the soil through cracks in the process building floors and floor drains.

6.1.1 Migration in Vadose Zone

The sources listed above may have resulted in CAH and BTEX contamination in both the surface (Figure 5-1) and subsurface (Figure 5-20) soils. At the Site, contamination in the relatively thin (<10 feet) vadose zone appears to coincide with the contaminant source areas in the fill layer (concrete, asphalt, wood, glass, brick, slag, and fly ash mixed with fine/medium grained sand). The uppermost (anthropogenic) soil layer ranges from approximately 6 to 10 ft bgs throughout the property with the thickest layers located beneath the former Martin Aaron Building and the Rhodes Drum Building. Fill material transitions into a grayish brown silt and sand mixture, shown on the cross sections at a depth of about 10 to 12 ft bgs.

In the vadose zone soils, CAH and BTEX constituents represent a source of contamination to the shallow groundwater. The anthropogenic layer and grayish brown silt and sand mixture are underlain by the Late Cretaceous Magothy Formation, which comprises the uppermost water bearing zone (Upper PRM) beneath the property. Precipitation on the ground surface that does not exit the property as runoff, percolates downward to the water table. During infiltration, the water leaches from the vadose zone soils those contaminants with sufficient concentrations or solubilities to either be washed downward or to be dissolved directly into the water. Because this process is controlled mainly by gravity, the transport of contaminants in the vadose zone is primarily downward, directly to the water table, with little to no lateral migration from the source areas.

Some of the sources noted above, such as the buried wastes, were interred below the water table, thus discharging contaminants directly to the groundwater.

6.1.2 Migration in Groundwater

Upon reaching the water table in the Upper PRM Aquifer, contaminants have moved both vertically by gravity and laterally under the influence of the ambient hydraulic gradient. Contaminant concentrations in wells located southeast of Martin Aaron (MW-9S/D, MW-20S/M/R/D and MW-11S) indicate that contaminated groundwater has migrated off the property. Figures 6-1 through 6-6 present isopleths of total VOC concentrations (including detections below groundwater screening criteria) in the Surficial Upper PRM Aquifer, the Intermediate Upper PRM Aquifer, and in the isolated zone between the Upper and Middle PRM Aquifers. No VOCs were detected in the Upper Middle PRM Aquifer. With respect to concentrations below detection limits, the horizontal extent of VOC contamination plume is undefined in the Surficial Upper PRM Aquifer to the east, southeast, and south of the Site,

the Intermediate Upper PRM Aquifer to the west, south and in the isolated sand unit between the two aquifers.

The VOC plume is over 1000 feet long and approximately 600 feet wide in the Surficial Upper PRM Aquifer, but narrows with depth to approximately 400 feet wide in the Intermediate Upper PRM Aquifer.

Vertically, the bottom of the plume appears to be bounded by the deepest clay unit in the confining complex between the Upper PRM and the Middle PRM Aquifers (Figure 6-7). In the Upper PRM Aquifer, contamination appears to spread laterally along the top surfaces of the thin intermittent clay units.

Concentrations of CAHs and BTEX compounds have been plotted versus distance along the centerline of the groundwater plume in the Surficial Upper PRM (Figure 6-8). BTEX compounds (benzene, ethylbenzene and xylenes) are highest in concentration (up to 100 $\mu\text{g/L}$) in the vicinity of MW-5S, MW-15S and MW-12S in the southwest portion of Martin Aaron near source areas. BTEX compounds decline to concentrations lower than 10 $\mu\text{g/L}$ downgradient (southeast) of MW-14S. CAH compounds (TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCA) are highest in concentration (up to 300 $\mu\text{g/L}$) in the vicinity of MW-12S and MW-14S, also near source areas. The highest concentrations of the CAHs appear to be the transformation products such as cis-1,2-DCE. Concentrations of CAH transformation products drop to levels below 10 $\mu\text{g/L}$ in wells off of the property (MW-20S and MW-11S), although cis-1,2-DCE is still above these levels (23 $\mu\text{g/L}$) in MW-9S. Total CAH concentrations are less than 10 $\mu\text{g/L}$ at the distal downgradient well MW-11S.

As shown on Figure 6-9, concentrations of CAHs compounds and benzene have been plotted versus distance along the centerline of the groundwater plume in the Intermediate Upper PRM (Figure 6-9). CAH transformation compounds (cis-1,2-DCE, and vinyl chloride) are the highest in concentration (up to 60 $\mu\text{g/L}$) in wells on the property, but decrease to levels below 10 $\mu\text{g/L}$ in the downgradient wells off of the Martin Aaron property. Benzene concentrations are below 10 $\mu\text{g/L}$, but are highest in the upgradient well MW-17M (8.3 $\mu\text{g/L}$) and fall below method detection limits immediately downgradient.

As shown on Figure 6-9, MTBE concentrations are greater in the Intermediate Upper PRM Aquifer than in the Surficial Upper PRM Aquifer. Further, MTBE concentrations along the centerline of the plume in the Intermediate Upper PRM Aquifer are remarkably uniform, regardless of location with respect to groundwater flow, either upgradient or downgradient. The uniformity of MBTE concentrations across the property in the Intermediate Upper PRM Aquifer, and its absence in wells of the Surficial Upper PRM Aquifer suggests the compound may originate upgradient of the Site.

Trace metal concentrations were also plotted versus distance along the centerline of the groundwater plume in the Surficial Upper PRM (Figure 6-10). Concentrations of dissolved arsenic, barium, and chromium (total) are one order-of-magnitude higher in wells on the Martin Aaron property than in the downgradient, except for chromium (total) which increases slightly in MW-11S. Elevated concentrations of these metals coincides with the locations of the source areas.

6.1.2.1 Transport Away from Site

Ultimately, groundwater from the Site flows towards the City of Camden wellfield, approximately 0.7 miles to the east. The profile of the VOC contaminant plume concentrations as characterized by monitoring wells at Martin Aaron show that concentrations decline two orders of magnitude from over 300 $\mu\text{g/L}$ to less than 10 $\mu\text{g/L}$ in 600 feet from the most contaminated well (Figures 6-8 and 6-9). Therefore, groundwater contaminants at the Site are not expected to migrate to the wellfield at detectable concentrations. Samples collected in June and September 2002 from the City of Camden Well 7 (an emergency back-up well), exhibited concentrations of only iron (16.5 and 16.9 mg/L) and manganese (0.33 and 0.35 mg/L) above the groundwater screening criteria. Iron and manganese concentrations are typically elevated in the PRM System aquifers particularly in locations downgradient of the recharge areas. Elevated concentrations of iron and manganese are consistent with the acidic pH and the reduced oxidation/reduction potential in those areas.

6.2 Contaminant Persistence

The behavior of contaminants at the Site is determined by their physical, chemical, and biological interaction with the vadose zone and groundwater environment. Mobility and persistence of contaminants in groundwater and soil are important characteristics in evaluating contaminant behavior and predicting a contaminant's fate. Mobility is the potential for a contaminant to migrate from the Site, while persistence is the duration a chemical will remain in the subsurface as a contaminant. Environmental factors that affect the behavior of contaminants include concentration of other chemicals dissolved in pore or groundwater, background water chemistry, organic matter content of the groundwater and the formation, and microbial activity.

Since 1997, up to six rounds of groundwater samples have been collected from the earlier monitoring wells at the Site. Subsequently a database is available for evaluating contaminant concentrations with time in well clusters MW-1 through MW-11 which are screened within the Surficial and Intermediate Upper PRM Aquifer zones. As expected, the recently installed monitor wells have not been sampled as many times as the oldest wells.

To gain a better understanding of temporal concentration patterns, CAH and BTEX compound concentrations from select wells located along the plume centerline with more than three sampling events (MW-1S, MW-5S, MW-11S, MW-1M and MW-9D) were plotted over time (Figures 6-11 through Figure 6-15).

In the Surficial Upper PRM wells (MW-1S, MW-5S and MW-11S), the overall trend in CAH and BTEX concentrations shows a slight decline over the last four years. The trends in MW-1S (Figure 6-11) and MW-11S (Figure 6-13) show nearly an order-of-magnitude decline to levels below 2 $\mu\text{g/L}$. Concentrations in MW-5S, closer to the plume center, decline by about one-half (Figure 6-12).

In the Intermediate Upper PRM wells (MW-1M and MW-9D), the overall trend in concentrations shows a slight increase over the last few years in the detected compounds. The trends in MW-1M (Figure 6-14) show a slight increase in the concentrations of CAH transformation products like cis-1,2-DCE, vinyl chloride, and MTBE. Concentration trends

in MW-9D (Figure 6-15) show a slight increase in the concentrations of CAH transformation product cis-1,2-DCE and in MTBE. Increasing concentrations of transformation products in the deeper groundwater are indicative of continued downward migration of a degrading CAH plume.

A contaminant plume is considered to have attained steady state conditions if the extent of the plume has not changed over a significant period of time, and variations in concentrations from monitoring wells in the plume can be explained by random factors such as water table fluctuations, sampling variability, and analytical uncertainty (Chiang and McAllister, 1994). For a plume to attain a steady state, the rate of natural attenuation must equal the rate of contaminant addition to the aquifer from the source. If concentrations within a plume appear relatively constant between sampling events (reasonably separated by time), then natural attenuation of the plume is likely to be occurring.

The overall decline in contaminant concentrations with time, from 1997 to 2002, in the Surficial Upper PRM Aquifer would suggest that the contaminant plume was receding over this time period. Plume recession could be related to removal of the primary contaminant source (buried drums). A receding contaminant plume occurs, in the absence of active remediation, when the rate of natural attenuation of contamination exceeds the rate at which contaminants enter the groundwater from a source. Typically, under receding conditions, the contaminant plume has expanded to a maximum extent. Then the leading edge recedes as natural attenuation occurs along the periphery of the plume. The conditions at the Site would suggest that the contaminant plume is approaching equilibrium with residual contamination which remains in the vadose zone. Although concentrations in the Intermediate Upper PRM Aquifer increase slightly, CAHs are typically comprised to dechlorinated transformation products like cis 1,2-DCE.

6.2.1 CAH Attenuation

Natural attenuation of CAHs in groundwater can be identified by several criteria including:

1. Evaluating reductions in total concentrations with time.
2. The identification of transformation products resulting from the breakdown of more chlorinated forms of CAH's to less chlorinated forms.
3. Examining the geochemical signature of common electron acceptors in groundwater.

Time-related concentrations of VOCs associated with the Site were examined above and were shown to be mostly stable or declining over the six years of investigation. Geochemical parameters including common electron acceptors (oxygen, nitrate, sulfate iron, manganese, etc.) are discussed in Section 6.4.4.3.

The degradation sequence for chloroethenes appears to proceed from PCE to TCE to cis-1,2-DCE with trans-1,2 DCE and 1,1-DCE (Lee, et, al. 1995) as minor products (Figure 6-16). In the transformation from TCE to less chlorinated DCE's, the compound loses a chlorine ion and gains a hydrogen (reductive dehalogenation). Further progression of the sequence of transformation can result in the formation of chloroethane or vinyl chloride and ultimately

to water, carbon dioxide, and chloride. Under suitable conditions, the degradation of TCE, with time, can lead to the formation of up to seven less chlorinated compounds.

To examine the relationship between TCE and its known breakdown product, cis-1,2-DCE, concentrations of these compounds from plume-center monitoring wells in both the Surficial and Intermediate Upper PRM were plotted against one another in X- Y plots (Figures 6-17 and 6-18) using analytical data from September 2002. Figure 6-17 shows that concentrations of cis-1,2-DCE are much greater than TCE in the Surficial Upper PRM Aquifer. Concentrations of cis-1,2-DCE are also much greater than TCE in the Intermediate Upper PRM Aquifer (Figure 6-18). As cis-1,2-DCE was not disposed of at the Site, the appearance of this compound probably results from the degradation of more chlorinated CAHs such as TCE and PCE. The fairly strong relationship in relative concentrations between TCE and cis-1,2-DCE indicates that TCE is probably degrading to cis-1,2-DCE. As concentrations of cis-1,2-DCE are now greater than TCE, the progression of this degradation sequence appears relatively advanced.

6.3 Attenuation Mechanisms

Many natural mechanisms can influence the migration of contamination in groundwater (Table 6-1). These mechanisms include hydrodynamic, biological, and chemical (abiotic) processes that reduce the concentrations of specific contaminants. Contaminant attenuation can result in the inhibition of the overall migration of the contaminant plume eventually reducing the size of the plume and contaminant mass. Biological attenuation mechanisms can occur in both aerobic and anaerobic conditions mitigated by bacteria. Abiotic mechanisms of attenuation of CAH compounds include volatilization, sorption, hydrolysis and dehalogenation. Hydrodynamic mechanisms do not appear to be significant at the Site. However, there is significant evidence of biological and abiotic attenuation.

6.3.1 Hydrodynamic Attenuation

Hydrodynamic attenuation involves physical mechanisms that reduce constituent concentrations by the movement of flowing groundwater. In the absence of physical or chemical attenuation mechanisms, the physical process by which solutes are transported by flowing groundwater is known as advection. The actions of dispersion and diffusion result in reduced constituent concentrations through dilution, rather than the destruction of the constituent. In addition, contaminant migration in groundwater is based on retardation according to the amount of organic carbon present and its partition coefficient.

The contaminant plume originating from the Site should extend more than a mile given the estimated groundwater flow velocities at the Martin Aaron Site (up to 0.5 ft/day, based on slug testing results and average groundwater gradients), and that CAHs could have been migrating in the groundwater since 1969. However, CAH concentrations decline over two orders of magnitude to less than 10 $\mu\text{g/l}$ in less than 600 ft from the most contaminated part of the plume (Figure 6-1). Given the rapid decline in concentrations with distance from the source area, extensive downgradient migration of the plume at significant concentrations (greater than 100 $\mu\text{g/l}$) or even concentrations above 10 $\mu\text{g/L}$ is unlikely.

6.3.1.1 Dispersion and Diffusion

Hydrophobic solutes that do not react with the groundwater or surrounding aquifer materials should migrate at the same velocity as the flowing groundwater. Solutes however have a tendency to spread both longitudinally and transversely along the expected flowpath. This tendency is known as hydrodynamic dispersion and results from the mechanical mixing mechanisms along the flowpath.

Hydrodynamic dispersion can occur in three dimensions; parallel to the flowpath (longitudinal), and perpendicular to the flowpath in two directions, vertically and laterally (transverse). Typically, longitudinal dispersion is significantly greater than transverse dispersion, particularly in areas where the hydraulic gradient is high (Freeze and Cherry, 1979). Dispersivity spreads contaminants along the flowpath and subsequently reduces contaminant concentrations at any point in the flow system. However, contamination mass is not reduced or attenuated. Total VOC isopleths along Cross Section B-B' (Figure 6-7) suggest constituents spread laterally along the upper surface of clay units during vertical migration.

Molecular diffusion is the random movement of molecules in a fluid due to concentration gradients. Molecular diffusion is controlled by Fick's Law that states that the diffusion rate is proportional to the concentration gradient (Dragun, 1988). Diffusion allows for the migration of contaminants out of the flowpath into less permeable portions of the aquifer.

Because contaminants diffuse into the less accessible aquifer pore throats, molecular diffusion is considered the main limiting factor for the ultimate success of many remedial technologies that use water and/or air as the conducting medium. Although contaminant mass can be removed from the main flowpath of an aquifer, contamination in less accessible areas (such as fine-grained lenses) cannot be readily removed. However contaminants in these portions of the aquifer, can remain as a source of contamination to groundwater migrating along the main flowpaths. During a typical remediation project, large amounts of contaminant mass are removed quickly when the project is first implemented. However, residual concentrations are hardly ever reduced below relatively stringent groundwater cleanup thresholds. Contaminants diffused into the aquifer matrix continue to act as a widely distributed source to flowing groundwater.

6.4 Abiotic Processes

Abiotic processes affect contaminant transport by causing interactions between the contaminant and the stationary subsurface material (sorption, ion-exchange) or by changing the form of the contaminant (hydrolysis, redox reactions) with further reaction with the formation matrix. These processes are not mediated by bacteria or other microbes. Abiotic processes discussed in this section include volatilization, sorption, hydrolysis, and dehydrohalogenation.

6.4.1 Volatilization

Volatilization is defined as the loss of a chemical from the soil surface or water table into the atmosphere. The rate at which an organic chemical will migrate from the aqueous phase through air within soil pores and into the atmosphere is controlled by a complex sequence

of equilibria related to a chemical's path from adsorbed to a soil particle beneath the water table to escape to the atmosphere. CAH compounds at the Martin Aaron Site are nearly all volatile. A conventional index of volatility is Henry's Law Constant (K_h). Compounds with K_h values greater than 10^{-3} atmosphere-per-cubic meter per mole ($\text{atm}\cdot\text{m}^3/\text{M}$) are expected to volatilize easily from the aqueous to vapor phase, while K_h values less than 10^{-5} are relatively nonvolatile. All the compounds of concern considered for this evaluation except naphthalene exhibit Henry's Law Constants greater than 10^{-3} (Table 6.2).

Once a chemical reaches the water table, volatilization is usually not a major attenuation mechanism. Mass balance calculations from field experiments in a coarse sand, shallow unconfined aquifer with relatively high water level fluctuations have shown that volatilization accounts for less than 5 percent of total attenuation of contaminants (Chiang, 1988). Subsequently, volatilization should not play a significant role in degrading VOC concentrations.

6.4.2 Sorption

The second abiotic process, sorption, involves the partitioning of contaminants between the aqueous phase and aquifer matrix. Sorption can occur by reaction between a solute in the aqueous phase and the solid surface (adsorption) of minerals, or by the partitioning of two phases such as accumulation from groundwater into organic carbon (absorption). Sorption is controlled by the organic carbon content of the water bearing unit, the type and abundance of clay minerals within the unit, and the abundance of iron, manganese, and aluminum hydroxide minerals. With organic contaminants, sorption is mostly influenced by the organic carbon content of the native groundwater and the available organic carbon within the aquifer matrix. With the exception of naphthalene, the organic partitioning coefficients (K_{oc}) for the primary contaminants at the Site are relatively low (less than 1,000 ml/g). K_{oc} is a measurement of the tendency of an organic compound dissolved in water to be absorbed by organic carbon in soil or rock. Therefore, these compounds do not have a strong tendency to become absorbed (Table 6-2).

Nearly all the VOC contaminants encountered at the Site exhibit low dielectric constants and low water solubilities. These contaminants are hydrophobic and will not pass across water films that surround concentrations of organic material or clay minerals. Furthermore, the organic content of the sediments is relatively low, subsequently absorption should not exert a major influence on attenuation at the Martin Aaron Site.

The low dielectric constants (less than water) exhibited by the Site compounds indicates that they are not susceptible to polarization or orientation in an electric field. Consequently, these organic compounds should not adsorb to iron, manganese or aluminum oxyhydroxide minerals within the soil or rock matrix. This property of the contaminants is particularly applicable to the vadose zone at the Site because the overburden soils contain large amounts (greater than one percent of the bulk soil matrix) of iron and manganese oxyhydroxide minerals. Contaminants will not be readily adsorbed to the soil matrix and therefore adsorption is probably not a prevalent mechanism of attenuation at the Site.

Although sorption is not a dominant attenuation process at the Site, quantification of the actual amount of sorption can be worthwhile for estimating plume extent and duration. Partitioning of a compound between the solid and aqueous phase is described by the

distribution coefficient (K_d) which is defined as the ratio of the solute concentration to the mass of solute absorbed or precipitated on solids, per unit dry mass of porous media.

This coefficient can be calculated directly by dividing contaminant concentrations in groundwater (mg/L) by contaminant concentrations in a soil sample (mg/kg) from the same interval. In the absence of this type of data (as at the Martin Aaron Site), the K_d can be estimated using the following equation:

$$K_d = 0.63 \times K_{oc} \times f_{oc}$$

Where: K_d = Distribution coefficient (ml/g)
 K_{oc} = Organic partition coefficient (ml/g)
 f_{oc} = Organic content of formation (g/ml)

The K_d of a compound is used to determine its mobility and tendency to interact with aquifer materials along the flowpath in relation to the average groundwater velocity. This relationship has been designated as the compound's retardation factor (R_f) and is based on the compound's K_d , along with the bulk density and porosity of the formation as follows:

$$R_f = 1 + (Pb/0) K_d$$

Where: R_f = Retardation Factor
 Pb = Bulk Density (g/ml)
 0 = Porosity of aquifer materials
 K_d = Distribution Coefficient

Retardation factors were estimated for the most pervasive compounds at the Site (Table 6-3). For unconsolidated soils dominated by sand, the bulk density of the formation was assumed to be 2.65 g/ml with a porosity of 0.25. The organic fraction (f_{oc}) for the unconsolidated aquifer was estimated to be relatively low (0.002 g/ml) based on the predominance of sand. The R_f for organic compounds at the Martin Aaron Site ranges from slightly greater than 2.0 for mobile, hydrophobic compounds such as vinyl chloride (Table 6-3) to greater than 6.1 for less mobile compounds such as xylene.

6.4.3 Hydrolysis

A third abiotic mechanism for VOC attenuation includes hydrolysis and dehalogenation reactions. Hydrolysis is defined as a chemical reaction in which a dissolved compound is degraded by a reaction with water, the hydronium ion (H^+), and the hydroxyl ion (OH^-). These mechanisms have been shown in laboratory studies to degrade halogenated compounds such as 1,2-DCE (Barbee, 1994). For TCE, an indication of abiotic dehalogenation can be ascertained by comparing concentrations of immediate breakdown products. With abiotic dehalogenation, concentrations of trans-1,2-DCE should be greater than cis 1,2-DCE (Barber, 1994). Furthermore, in biological degradation, concentrations of cis 1,2-DCE are generated at 30 times the concentration of trans-1,2-DCE. For the onsite plume-center well MW-12S and MW-14S, concentrations of cis-1,2-DCE exceed trans-1,2-DCE by 16-18 times, which is a reasonable indication of elevated biological attenuation. Hydrolysis can also be a dominant attenuation mechanism under certain conditions.

However, the processes are temperature sensitive and are often negligible at ambient groundwater temperatures.

6.4.4 Biologic Attenuation

Several types of evidence can be utilized to document the occurrence of natural attenuation by biodegradation. This evidence includes (1) the confirmed loss of contamination at a field Site; (2) geochemical evidence; and (3) microcosm studies. Laboratory microcosm studies are probably not applicable for the Martin Aaron Site at this time. Microcosm studies are used to estimate biodegradation rates and are more suited to research applications. The other types of evidence are readily available for the Martin Aaron Site. Results of the evaluation of historical data at the Site indicates that contaminant concentrations are stable or declining. Groundwater geochemistry will be evaluated in this section to determine the relative importance of each mechanism of biological attenuation occurring at the Site.

6.4.4.1 Aerobic Biodegradation

Aerobic bacteria utilize oxygen as an electron acceptor to convert organic contaminants (in a redox reaction) to carbon dioxide, water, bicarbonate, and biomass (McAllister and Chiang, 1994). In this process, indigenous bacteria utilize dissolved oxygen in groundwater as an electron acceptor to degrade the hydrocarbon substrate. At a field laboratory Site where dissolved oxygen (DO) was measured, an inverse correlation occurred between dissolved oxygen and aromatic hydrocarbons (benzene, toluene, ethylbenzene, and xylene; Chiang, 1988). Unlike aromatic hydrocarbons, published sources indicate that CAHs (Barbee, 1994; Wiedemeyer, 1995) are not readily degraded by aerobic bacteria. The DO concentrations in the Surficial Upper PRM Aquifer range from 0.36 to 6.71 mg/L (Figure 6-19). The oxic background levels of DO in the Upper PRM Aquifer may contribute to the relatively limited nature of BTEX migration. DO concentrations are anoxic (less than 1.0 mg/L) in the central portion of the contaminant plume in the Surficial Upper PRM Aquifer. By comparison, DO concentrations in the Intermediate Upper PRM Aquifer are oxic (greater than 2.0 mg/L; Figure 6-20).

6.4.4.2 Anaerobic Biodegradation

Anaerobic bacteria substitute other ions for oxygen as electron acceptors in the degradation of an organic substrate. These electron acceptors include nitrate (NO_3^-), sulfate (SO_4^{2-}), ferric iron (Fe^{+3}), manganese (Mn^{+4}) and carbon dioxide (CO_2). In the degradation of CAHs, anaerobic bacteria utilize natural organic matter in the formation or other available substrate (aromatic hydrocarbon contamination) if present, as a source of energy (food), while utilizing electron acceptors for respiration.

Transformation of CAHs occurs from the release of enzymes from the metabolic process. As this co-metabolic, reductive dehalogenation continues, degradation products composed of less chlorinated hydrocarbons are formed. Transformation products may then serve as primary substrates for further degradation of remaining CAH's (Barbee, 1994). Degradation of CAHs can be problematic because less halogenated transformation products like vinyl chloride are more toxic than the primary forms (TCE, PCE).

An evaluation described above indicates that CAH compounds are degrading in the groundwater below the Martin Aaron Site. The distribution in concentrations for primary

compounds (TCE and PCE) in comparison to degradation products indicates that degradation is at an advanced stage. At the Martin Aaron Site, BTEX compounds may act as a primary substrate for bacteria. Thus, BTEX serves as an electron donor for cometabolic reactions that attenuate CAH's. For TCE, the predominance of cis-1,2-DCE as a degradation product, over trans-1,2-DCE suggests that the predominant degradation mechanism is biological.

6.4.4.3 Geochemical Indicators

The mode of biodegradation can be identified by examining the behavior of certain geochemical indicator parameters. These parameters include sulfate, iron, manganese, alkalinity (bicarbonate), and carbon dioxide. Nitrate was analyzed in groundwater samples from wells at the Site, but was found to be nearly universally less than method detection limits (MDL). Thus, denitrification cannot be considered a significant factor in the attenuation of BTEX of CAH's. Chloride is also a useful parameter, as an increase in this element suggests the ultimate degradation of CAHs. However, chloride cannot be used to identify the degradation mechanism.

In decreasing order of preference, anaerobic bacteria utilize nitrate, ferric iron, manganese, sulfate, and carbon dioxide as electron acceptors in the absence or in lieu of DO. The sequence in which organisms reduce these constituents is controlled by the amount of energy required by these organisms to add electrons to the atomic structure of the acceptor. Bacteria preferentially utilize the constituent that requires the least amount of energy to reduce.

Other parameters also provide evidence of biodegradation and microbial activity. Bicarbonate (converted from alkalinity measurements) is a byproduct of the enzymatic process of microbial respiration and excretion processes of bacteria and can be used as an index of microbial activity.

The spatial relationship of geochemical parameters was examined along the centerline of the plume (Figure 6-21). For this evaluation, total CAH concentrations at the Martin Aaron Site are not sufficiently high enough to stoichiometrically generate strongly detectable changes in the concentrations of electron acceptors. To cause identifiable changes in electron acceptors, total organic contaminant concentrations should exceed 1.0 mg/l. MW-14S has the highest total organic concentration, but it is still less than 400 µg/L, or 0.4 mg/L. Subsequently, geochemical indicator parameters do not change appreciably across the Martin Aaron Site.

The pattern of geochemical parameters at the Site along the trace of the plume provides a weak indication that anaerobic biodegradation is occurring in the Surficial Upper PRM Aquifer (Figure 6-21).

As expected, dissolved oxygen concentrations decline in the central portion of the plume in the Surficial Upper PRM Aquifer for samples collected in September 2002 (Figure 6-19). In the area around MW-5S, DO concentrations are less than 0.5 mg/L compared to greater than 2.0 mg/L at outlying wells. By comparison, DO concentrations in the central portion of the plume in the Intermediate Upper PRM Aquifer are greater than 2.0 mg/L (Figure 6-20).

Unlike DO, nitrate and sulfate, iron and manganese are metabolic byproducts of anaerobic respiration. Bacteria reduce ferric iron (Fe III) and manganese (Mn IV) within amorphous (poorly crystallized) minerals and from surfaces in the surrounding aquifer matrix, releasing ferrous iron (Fe II) and the reduced form of manganese (Mn II) into groundwater. Fe II and Mn II are more soluble in groundwater than Fe III and Mn IV, respectively. Therefore, iron and manganese concentrations should be greater in the groundwater in the presence of active anaerobic bacteria than in uncontaminated areas. Evaluation of iron and manganese in the groundwater from contaminated in the PRM Aquifer System can be difficult. Elevated iron and manganese concentrations often occur naturally in the PRM Aquifers and are typically controlled by thermodynamic equilibrium conditions.

The distribution of elevated iron concentrations in the Surficial Upper PRM Aquifer appear to be weakly correlative with the most contaminated portions of the plume (Table 6-4; Figures 6-21 and 6-22). Iron concentrations range up to 21.6 mg/L in MW-12S compared with background concentrations of less than 0.5 mg/L outside the area of the plume. Elevated manganese concentrations are not correlative with the location of the contaminant plume. Manganese concentrations are elevated, ranging around 0.25 mg/L in the area of the plume, increasing above 0.5 mg/L outside the plume boundary (Figure 6-23). Thus, manganese is not a metabolic byproduct of anaerobic biodegradation at the Site. Alkalinity concentrations, a respiration product of anaerobic bacteria are elevated in the central portion of the plume around MW-1S and MW-5S (Figure 6-24). Elevated alkalinity concentrations in the central portion of the plume suggests that anaerobic bacteria are active in the central portion of the contaminant plume.

As shown on Figure 6-25, similar to manganese, the distribution of sulfate concentrations is not particularly correlative with anaerobic biodegradation of the plume in the Surficial Upper PRM Aquifer. Only the low sulfate concentrations at MW-5S and MW-15S, and the presence of sulfide suggests that some sulfate reduction is occurring locally around the source area. In general, sulfate concentrations within the boundary of the contaminant plume are greater than concentrations outside the plume. Consistent with the relative absence of sulfate reduction, the reduction of carbon dioxide to methane (methanogenesis) is probably not occurring at the site.

Examination of electron acceptor parameters in the Intermediate Upper PRM Aquifer, reveals a relatively random profile (Figure 6-26 through 6-29). Concentrations of dissolved oxygen and sulfate are uniform, or elevated in the central portion of the plume. Although iron and manganese concentrations are higher within the boundaries of the plume, alkalinity concentrations are lower, suggesting limited anaerobic biodegradation activity. In summary, the geochemistry of groundwater in the Intermediate Upper PRM Aquifer does not appear to be influenced by anaerobic biodegradation.

6.5 Conceptual Model

Figure 6-30 presents a conceptual model of the fate and transport of contaminants at the Site. Compounds such as CAHs and BTEXs are introduced into the soil or directly into the groundwater from leaking or buried wastes at the ground surface. Contaminants are leached from the soil and are transported downward to the water table by infiltrating precipitation. Once in the Surficial Upper PRM Aquifer, the contaminants are transported

both vertically and laterally, spreading outward and along the path of groundwater flow away from the original source areas. Some spreading occurs along the upper surface of clay confining beds.

The vertical extent of contaminant migration is delineated by the relatively continuous, yet complex, interbedded confining layer between the Upper and Middle PRM Aquifers at a depth of approximately 140 feet below ground surface. The lateral extent of contaminant migration is beyond the downgradient monitoring wells surrounding Martin Aaron. Although the groundwater velocities at the Site indicate that contaminant migration from historical Site activities could extend for more than a mile, the rapid decrease in concentration within the monitoring well network indicates that contaminants have migrated less than 10% of this possible distance (approximately 600 ft). Contaminant concentration trends with time indicate that the groundwater contaminant plume is not only stable, but may be decreasing due to mainly biological and abiotic natural attenuation mechanisms (see Table 6-1):

- CAH compounds: PCE, TCE and cis 1,2-DCE by anaerobic biodegradation through the reduction of Fe III to Fe II and sulfate adjacent to source areas in the Surficial Upper PRM Aquifer. Vinyl chloride degrades by aerobic biologic attenuation in an oxic environment. The data indicates no evidence of methanogenesis or manganese reduction;
- Anaerobic biodegradation is limited and appears associated with the biodegradation of BTEX compounds which serve as a primary substrate and electron donor. BTEX Compounds may be used as a carbon source for the co-metabolic degradation of CAH compounds;
- BTEX compounds: Benzene, ethylbenzene, toluene and xylenes degrade by aerobic biodegradation. Background oxic levels of DO in the Surficial Upper PRM Aquifer may contribute to the relatively limited nature of BTEX migration. DO concentrations are anoxic (less than 1.0 mg/L) in the area of the plume in the Surficial Upper PRM Aquifer;
- Geochemical evidence of aerobic (DO reduction) and anaerobic (iron and sulfate reduction) biodegradation appears limited to the Surficial Upper PRM Aquifer;
- MTBE: the higher, and consistent, concentrations in the Intermediate Upper PRM aquifer suggests the compound may originate upgradient of the Site;
- Metals: concentrations of trace metals such as arsenic, barium and chromium decrease by over one order-of-magnitude away from the source areas; concentrations iron and manganese that serve as electron acceptors during the biodegradation of CAHs appear elevated in the source areas, and immediately downgradient; and
- The vertical migration of BTEX appears to terminate at a clay confining unit that spans the Intermediate Upper PRM Aquifer, while CAH contamination has migrated approximately 70 feet deeper into the isolated sand unit between the Upper and Middle PRM Aquifers.

TABLE 6-1

Potential Natural Attenuation Mechanisms in Groundwater for Most Prevalent Site Compounds

Martin Aaron Superfund Site

Camden, NJ

Remedial Investigation Report

May 2004

Mechanism	Description	Compound	Effect on Contaminant		
Biological					
Aerobic	Microbes utilize oxygen as an electron acceptor to convert contaminant to CO ₂ , water, and biomass.	Vinyl Chloride Chloroethane	Most significant attenuation mechanism if sufficient dissolved oxygen is present (D.O. 1-2 mg/l).		
		PCE	None (a)		
		TCE	None (a)		
		1,1-DCE			
		1,2-cis DCE			
		1,1-DCA			
		1,1,1-TCA			
Anaerobic Dentrification Sulfate Reduction Methanogenic Fe III Reduction	Alternative electron acceptors (e.g. NO ₃ , Fe III CO ₂) are utilized by microbes to degrade contaminants.	Vinyl Chloride Chloroethane	Rates for this compound are typically slower than for aerobic biodegradation.		
		PCE	Probable for PCE, but slowly transformed to TCE the 3 types of DCE/DCA compounds, perhaps ultimately to vinyl chloride.		
		TCE 1,1,1-TCA	Probable for TCE but slow, metabolized to chlorinated acetic acid.		
		1,1-DCE 1,2-cis-DCE 1,1-DCA	At Martin Aaron, 1,1-DCE, 1,2-CIS-DCE, and 1,1-DCA appear to be a product of biodegradation of other chlorinated hydrocarbons by anaerobic bacteria.		
		Physical			
		Volatilization	Contaminants are removed from ground water by volatilization to the vapor phase in the unsaturated zone.	PCE TCE 1,1-DCE 1,2-cis-DCE 1,1-DCA 1,1,1-TCA Vinyl Chloride Chloroethane	Very volatile in vadose zone, or at water table.

TABLE 6-1

Potential Natural Attenuation Mechanisms in Groundwater for Most Prevalent Site Compounds

Martin Aaron Superfund Site

Camden, NJ

Remedial Investigation Report

May 2004

Mechanism	Description	Compound	Effect on Contaminant
Dispersion	Mechanical and molecular mixing processes reduce concentrations.	PCE TCE 1,1-DCE 1,2-cis-DCE 1,1-DCA 1,1,1-TCA Vinyl Chloride Chloroethane	Decrease concentrations but does not result in net loss of mass(b). Disperses plume along axis and transverse to axis.
Sorption	Contaminants partition between the aqueous phase and aquifer matrix. Sorption is influenced by organic content of soil, clay minerals and amorphous manganese-iron-aluminum hydrous oxides.	PCE TCE 1,1-DCE 1,2-cis-DCE 1,1-DCA 1,1,1-TCA Vinyl Chloride Chloroethane	Sorption retards plume migration but does not remove contaminants permanently from groundwater as contaminants may desorb. Contaminants listed in this table are relatively mobile and only minimally affected by sorption.
Chemical			
Hydrolysis, dehydrohalogenation, and other chemical reactions.	Hydrolysis and/or other chemical reactions occur in groundwater to reduce the mass of contaminant present.	PCE TCE 1,1-DCE	1,2-cis-DCE Relatively recalcitrant to both abiotic mechanisms under normal subsurface conditions (pH, temp).
		1,1-DCA 1,1,1-TCA Vinyl Chloride Chloroethane	Generally more susceptible to hydrolysis and dehalogenation than other aliphatic compounds under normal subsurface conditions
(a) Chiang and McAllister, 1994.			
(b) Schwile, 1988.			
(c) Barbee, 1994.			

TABLE 6-2
Chemical Specific Properties for Site Constituents
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

CAS No.	Compound	K _{oc} (L/kg)	D _{i,a} (cm ² /s)	D _{i,w} (cm ² /s)	S (mg/L)	H ¹ (dimensionless)
83-32-9	Acenaphthene	7.08E+03	4.21E-02	7.69E-06	4.24E+00	6.36E-03
67-64-1	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03
309-00-2	Aldrin	2.45E+06	1.32E-02	4.86E-06	1.80E-01	6.97E-03
120-12-7	Anthracene	2.95E+04	3.24E-02	7.74E-06	4.34E-02	2.67E-03
56-55-3	Benz(a)anthracene	3.98E+05	5.10E-02	9.00E-06	9.40E-03	1.37E-04
71-43-2	Benzene	5.89E+01	8.80E-02	9.80E-06	1.75E+03	2.28E-01
205-99-2	Benzo(b)fluoranthene	1.23E+06	2.26E-02	5.56E-06	1.50E-03	4.55E-03
207-08-9	Benzo(k)fluoranthene	1.23E+06	2.26E-02	5.56E-06	8.00E-04	3.40E-05
65-85-0	Benzoic acid	6.00E-01	5.36E-02	7.97E-06	3.50E+03	6.31E-05
50-32-8	Benzo(a)pyrene	1.02E+06	4.30E-02	9.00E-06	1.62E-03	4.63E-05
111-44-4	Bis(2-chloroethyl)ether	1.55E+01	6.92E-02	7.53E-06	1.72E+04	7.38E-04
117-81-7	Bis(2-ethylhexyl)phthalate	1.51E+07	3.51E-02	3.66E-06	3.40E-01	4.18E-06
75-27-4	Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.74E+03	6.56E-02
75-25-2	Bromoform	8.71E+01	1.49E-02	1.03E-05	3.10E+03	2.19E-02
71-36-3	Butanol	6.92E+00	8.00E-02	9.30E-06	7.40E+04	3.61E-04
85-68-7	Butyl benzyl phthalate	5.75E+04	1.74E-02	4.83E-06	2.69E+00	5.17E-05
86-74-8	Carbazole	3.39E+03	3.90E-02	7.03E-06	7.48E+00	6.26E-07
75-15-0	Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.19E+03	1.24E+00
56-23-5	Carbon tetrachloride	1.74E+02	7.80E-02	8.80E-06	7.93E+02	1.25E+00
57-74-9	Chlordane	1.20E+05	1.18E-02	4.37E-06	5.60E-02	1.99E-03
06-47-8	<i>p</i> -Chloroaniline	6.61E+01	4.83E-02	1.01E-05	5.30E+03	1.36E-05
108-90-7	Chlorobenzene	2.19E+02	7.30E-02	8.70E-06	4.72E+02	1.52E-01
124-48-1	Chlorodibromomethane	6.31E+01	1.96E-02	1.05E-05	2.60E+03	3.21E-02
67-66-3	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01
95-57-8	2-Chlorophenol	3.88E+02	5.01E-02	9.46E-06	2.20E+04	1.60E-02
218-01-9	Chrysene	3.98E+05	2.48E-02	6.21E-06	1.60E-03	3.88E-03
72-54-8	DDD	1.00E+06	1.69E-02	4.76E-06	9.00E-02	1.64E-04
72-55-9	DDE	4.47E+06	1.44E-02	5.87E-06	1.20E-01	8.61E-04

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 May 2004

CAS No.	Compound	K _{OC} (L/kg)	D _{i,a} (cm ² /s)	D _{i,w} (cm ² /s)	S (mg/L)	H ¹ (dimensionless)
50-29-3	DDT	2.63E+06	1.37E-02	4.95E-06	2.50E-02	3.32E-04
53-70-3	Dibenz(a,h)anthracene	3.80E+06	2.02E-02	5.18E-06	2.49E-03	6.03E-07
84-74-2	Di-n-butyl phthalate	3.39E+04	4.38E-02	7.86E-06	1.12E+01	3.85E-08
95-50-1	1,2-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	1.56E+02	7.79E-02
106-46-7	1,4-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	7.38E+01	9.96E-02
91-94-1	3,3-Dichlorobenzidine	7.24E+02	1.94E-02	6.74E-06	3.11E+00	1.64E-07
75-34-3	1,1-Dichloroethane	3.16E+01	7.42E-02	1.05E-05	5.06E+03	2.30E-01
107-06-2	1,2-Dichloroethane	1.74E+01	1.04E-01	9.90E-06	8.52E+03	4.01E-02
75-35-4	1,1-Dichloroethylene	5.89E+01	9.00E-02	1.04E-05	2.25E+03	1.07E+00
156-59-2	cis-1,2-Dichloroethylene	3.55E+01	7.36E-02	1.13E-05	3.50E+03	1.67E-01
156-60-5	trans-1,2-Dichloroethylene	5.25E+01	7.07E-02	1.19E-05	6.30E+03	3.85E-01
120-83-2	2,4-Dichlorophenol	1.47E+02	3.46E-02	8.77E-06	4.50E+03	1.30E-04
78-87-5	1,2-Dichloropropane	4.37E+01	7.82E-02	8.73E-06	2.80E+03	1.15E-01
542-75-6	1,3-Dichloropropene	4.57E+01	6.26E-02	1.00E-05	2.80E+03	7.26E-01
60-57-1	Dieldrin	2.14E+04	1.25E-02	4.74E-06	1.95E-01	6.19E-04
84-66-2	Diethylphthalate	2.88E+02	2.56E-02	6.35E-06	1.08E+03	1.85E-05
105-67-9	2,4-Dimethylphenol	2.09E+02	5.84E-02	8.69E-06	7.87E+03	8.20E-05
51-28-5	2,4-Dinitrophenol	1.00E-02	2.73E-02	9.06E-06	2.79E+03	1.82E-05
121-14-2	2,4-Dinitrotoluene	9.55E+01	2.03E-01	7.06E-06	2.70E+02	3.80E-06
606-20-2	2,6-Dinitrotoluene	6.92E+01	3.27E-02	7.26E-06	1.82E+02	3.06E-05
117-84-0	Di-n-octyl phthalate	8.32E+07	1.51E-02	3.58E-06	2.00E-02	2.74E-03
115-29-7	Endosulfan	2.14E+03	1.15E-02	4.55E-06	5.10E-01	4.59E-04
72-20-8	Endrin	1.23E+04	1.25E-02	4.74E-06	2.50E-01	3.08E-04
100-41-4	Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.23E-01
206-44-0	Fluoranthene	1.07E+05	3.02E-02	6.35E-06	2.06E-01	6.60E-04
86-73-7	Fluorene	1.38E+04	3.63E-02	7.88E-06	1.98E+00	2.61E-03
76-44-8	Heptachlor	1.41E+06	1.12E-02	5.69E-06	1.80E-01	4.47E-02
1024-57-3	Heptachlor epoxide	8.32E+04	1.32E-02	4.23E-06	2.00E-01	3.90E-04

TABLE 6-2
 Chemical Specific Properties for Site Constituents
 Martin Aaron Superfund Site
 Camden, NJ
 Remedial Investigation Report
 May 2004

CAS No.	Compound	K _{oc} (L/kg)	D _{i,a} (cm ² /s)	D _{i,w} (cm ² /s)	S (mg/L)	H ¹ (dimensionless)
118-74-1	Hexachlorobenzene	5.50E+04	5.42E-02	5.91E-06	6.20E+00	5.41E-02
87-68-3	Hexachloro-1,3-butadiene	5.37E+04	5.61E-02	6.16E-06	3.23E+00	3.34E-01
319-84-6	α-HCH (α-BHC)	1.23E+03	1.42E-02	7.34E-06	2.00E+00	4.35E-04
319-85-7	β-HCH (β-BHC)	1.26E+03	1.42E-02	7.34E-06	2.40E-01	3.05E-05
58-89-9	γ-HCH (Lindane)	1.07E+03	1.42E-02	7.34E-06	6.80E+00	5.74E-04
7-47-4	Hexachlorocyclopentadiene	2.00E+05	1.61E-02	7.21E-06	1.80E+00	1.11E+00
67-72-1	Hexachloroethane	1.78E+03	2.50E-03	6.80E-06	5.00E+01	1.59E-01
193-39-5	Indeno(1,2,3- <i>cd</i>)pyrene	3.47E+06	1.90E-02	5.66E-06	2.20E-05	6.56E-05
78-59-1	Isophorone	4.68E+01	6.23E-02	6.76E-06	1.20E+04	2.72E-04
7439-97-6	Mercury	---	3.07E-02	6.30E-06	---	4.67E-01
72-43-5	Methoxychlor	9.77E+04	1.56E-02	4.46E-06	4.50E-02	6.48E-04
74-83-9	Methyl bromide	1.05E+01	7.28E-02	1.21E-05	1.52E+04	2.56E-01
75-09-2 2	Methylene chloride	1.17E+01	1.01E-01	1.17E-05	1.30E+04	8.98E-02
95-48-7	2-Methylphenol	9.12E+01	7.40E-02	8.30E-06	2.60E+04	4.92E-05
91-20-3	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02
98-95-3	Nitrobenzene	6.46E+01	7.60E-02	8.60E-06	2.09E+03	9.84E-04
86-30-6	N-Nitrosodiphenylamine	1.29E+03	3.12E-02	6.35E-06	3.51E+01	2.05E-04
621-64-7	N-Nitrosodi- <i>n</i> -propylamine	2.40E+01	5.45E-02	8.17E-06	9.89E+03	9.23E-05
1336-36-3	PCBs	3.09E+05	---	---	7.00E-01	---
87-86-5	Pentachlorophenol	5.92E+02	5.60E-02	6.10E-06	1.95E+03	1.00E-06
108-95-2	Phenol	2.88E+01	8.20E-02	9.10E-06	8.28E+04	1.63E-05
129-00-0	Pyrene	1.05E+05	2.72E-02	7.24E-06	1.35E-01	4.51E-04
100-42-5	Styrene	7.76E+02	7.10E-02	8.00E-06	3.10E+02	1.13E-01
79-34-5	1,1,2,2-Tetrachloroethane	9.33E+01	7.10E-02	7.90E-06	2.97E+03	1.41E-02
127-18-4	Tetrachloroethylene	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01
108-88-3	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01
8001-35-2	Toxaphene	2.57E+05	1.16E-02	4.34E-06	7.40E-01	2.46E-04
120-82-1	1,2,4-Trichlorobenzene	1.78E+03	3.00E-02	8.23E-06	3.00E+02	5.82E-02

TABLE 6-2
Chemical Specific Properties for Site Constituents
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

CAS No.	Compound	K _{oc} (L/kg)	D _{i,a} (cm ² /s)	D _{i,w} (cm ² /s)	S (mg/L)	H ¹ (dimensionless)
71-55-6	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.05E-01
79-00-5	1,1,2-Trichloroethane	5.01E+01	7.80E-02	8.80E-06	4.42E+03	3.74E-02
79-01-6	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.10E+03	4.22E-01
95-95-4	2,4,5-Trichlorophenol	1.60E+03	2.91E-02	7.03E-06	1.20E+03	1.78E-04
88-06-2	2,4,6-Trichlorophenol	3.81E+02	3.18E-02	6.25E-06	8.00E+02	3.19E-04
108-05-4	Vinyl acetate	5.25E+00	8.50E-02	9.20E-06	2.00E+04	2.10E-02
75-01-4	Vinyl chloride	1.86E+01	1.06E-01	1.23E-06	2.76E+03	1.11E+00
108-38-3	<i>m</i> -Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.01E-01
95-47-6	<i>o</i> -Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.13E-01
106-42-3	<i>p</i> -Xylene	3.89E+02	7.69E-02	8.44E-06	1.85E+02	3.14E-01

K_{oc} = Soil organic carbon/water partition coefficient

D_{i,a} = Diffusivity in air (25C)

D_{i,w} = Diffusivity in water (25C)

S = Solubility in water (20-25C)

H¹ = Dimensionless Henry's law constant (HLC [atm-m³/mol] * 41) (25C)

K_d = Soil-water partition coefficient

Sources:

1. Montgomery, J.H. and L.M. Welkom, Groundwater Chemicals Desk Reference, Lewis Publishers, Chelsea, Michigan, 1990.
2. Mabey, et al., "Aquatic Fate Process Data for Organic Priority Pollutants," EPA-440/4-81-014. Prepared by SRI International, EPA Contract Nos. 68-01-3867 and 68-03-2981, Dec. 1982, prepared for Monitoring and Data Support Division, Office of Water Regulations and Standards, Washington, DC.
3. Superfund Public Health Evaluation Manual, EPA/540/1-86/060 (OSWER Directive 9285.4-1), Oct. 1986, Office of Emergency and Remedial Response, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC.
4. Lyman, W.J., W.F.Reehl, and D.H.Rosenblatt, Handbook of Chemical Property Estimation Methods, McGraw-Hill, New York, 1982.
5. Suflita, J.M., "Microbial Ecology and Pollutant Biodegradation in Subsurface Ecosystems," in Transport and Fate of Contaminants in the Subsurface, EPA/625/4-89/019, Sept. 1989, U.S. Environmental Protection Agency, Center for Environmental Research Information, Cincinnati, OH.
6. Ellington, J.J., F.E.Stancil, Jr., and W.D.Payne, "Measurement of Hydrolysis Rate Constants for Evaluation of Hazardous Waste Land Disposal: Volume 1. Data on 32 Chemicals," EPA/600/S3-86/043, Apr. 1987, U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, GA.

TABLE 6-3

Retardation Factors for Common VOC's in Groundwater at Martin Aaron Site
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

Constituent	K _{oc} ⁽¹⁾ (ml/g)	K _D ⁽²⁾ (g/ml)	R _F ⁽³⁾
Benzene	58.9	0.074	1.79
Xylene	386	0.486	6.16
Toluene	182	0.229	3.43
Ethylbenzene	363	0.457	5.85
Tetrachloroethene	155	0.195	3.07
Trichloroethene	166	0.209	3.22
Cis 1,2Dichloroethene	355	0.447	5.74
Dichloropropane 1,2	43.7	0.055	1.58
Vinyl chloride	18.6	0.023	1.25
1,1 Dichloroethane	31.6	0.040	1.42

Notes:

foc: 0.002 g/g – fraction of organic carbon

Pb: 2.65 g/ml – Bulk density

Porosity: 0.25

⁽¹⁾ K_{oc} Organic partition coefficient

⁽²⁾ K_D Distribution Coefficient

⁽³⁾ R_F Retardation factor

TABLE 6-4

Groundwater Quality Parameters Surficial and Intermediate Upper PRM Aquifer
September 2002

Martin Aaron Superfund Site

Camden, NJ

Remedial Investigation Report

May 2004

Well Name	Iron (mg/L)	Manganese (mg/L)	Sulfate (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)
MW 1S	1.32	0.0667	15.1	0.05 U	1520
MW 4S	7.23	0.133	9.34 J	0.095 J	260
MW 5S	0.287	0.0067 B	5 U	0.05 U	1490
MW 8S	17.4	0.759 J	5 U	0.05 UJ	658
MW 9S	8.7 U	0.715 J	71	0.2	340
MW 10S	10	0.616	82.4	0.05 U	486
MW 11S	8.7 U	0.0118 B	78.7	4.88	182
MW 12S	21.6	0.461	166	0.05 U	446
MW 13S	0.235	0.011 B	54.2	0.135	1300
MW 14S	0.933 J	0.269 J	81.9	0.05 U	170
MW 15S	9.32	0.549	5.34	0.05 U	1050
MW 16S	4.09	0.346	65	0.05 U	276
MW 17S	3.33	0.132	45.9	0.05 U	290
MW 18S	25.4	1.35	5 U	0.05 U	456
MW 19S	3.59	0.52	5 U	0.05 U	460
MW 20S	0.0255 B	0.017	57.3	6.79	280
MW 21S	1.3	0.423	22.8	0.055	460
MW 22S	0.406	0.196	66.9	3.24	230
MW 1M	15.6	0.465	111	0.05 U	254
MW 11M	0.0672 B	1.95	43.2	0.63	420
MW 12M	29.9	0.442	94.5	0.05 U	296
MW 13M	20.4	0.696	88.1	0.05 U	284
MW 15M	27	1.74	54.8	0.05 U	182
MW 17M	2.61	0.65	69	0.205	230
MW 18M	26.9	0.278	57.7	0.05 U	308
MW 19M	7.55	0.589	40.9	0.05 U	200
MW 20M	22.7	1.11	54.3	0.05 U	370
MW 9D	10.2	1.47	73	0.095	290

Notes:

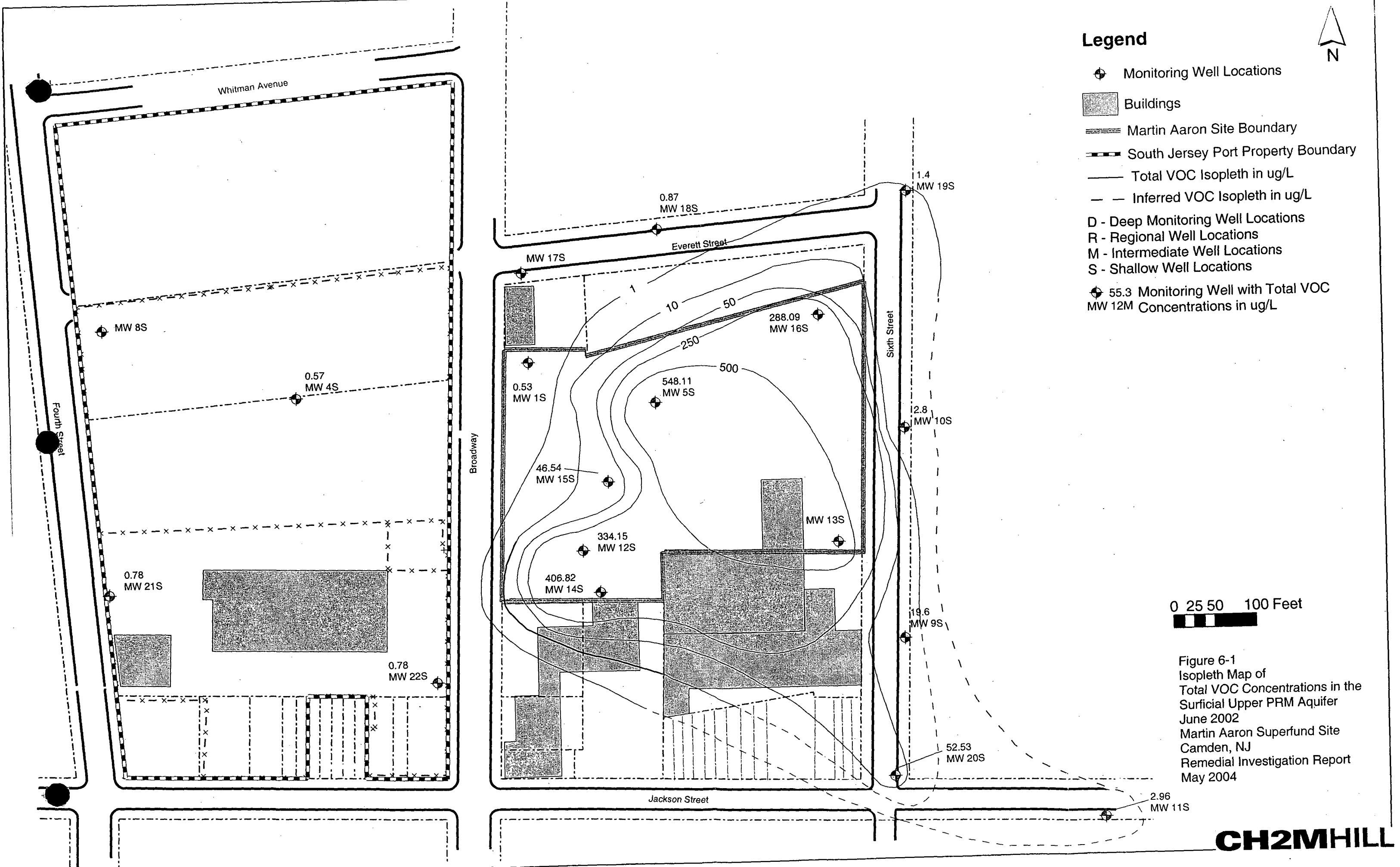
B - Detected in associated field blank

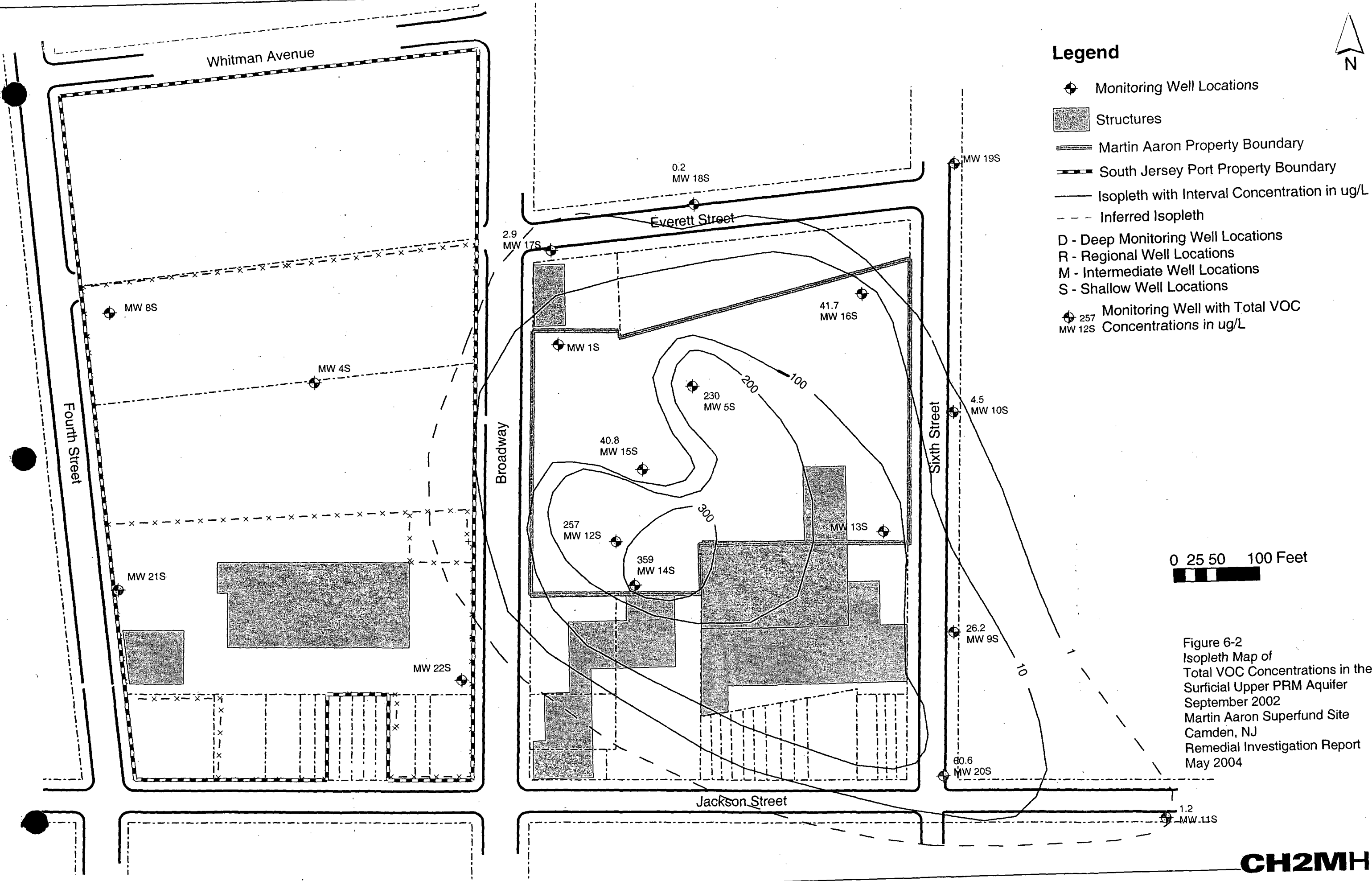
J - Estimated value

U - Not detected, reporting limit shown

Legend

- Monitoring Well Locations
- Buildings
- Martin Aaron Site Boundary
- South Jersey Port Property Boundary
- Total VOC Isopleth in ug/L
- Inferred VOC Isopleth in ug/L
- D - Deep Monitoring Well Locations
 R - Regional Well Locations
 M - Intermediate Well Locations
 S - Shallow Well Locations
- 55.3 Monitoring Well with Total VOC MW 12M Concentrations in ug/L

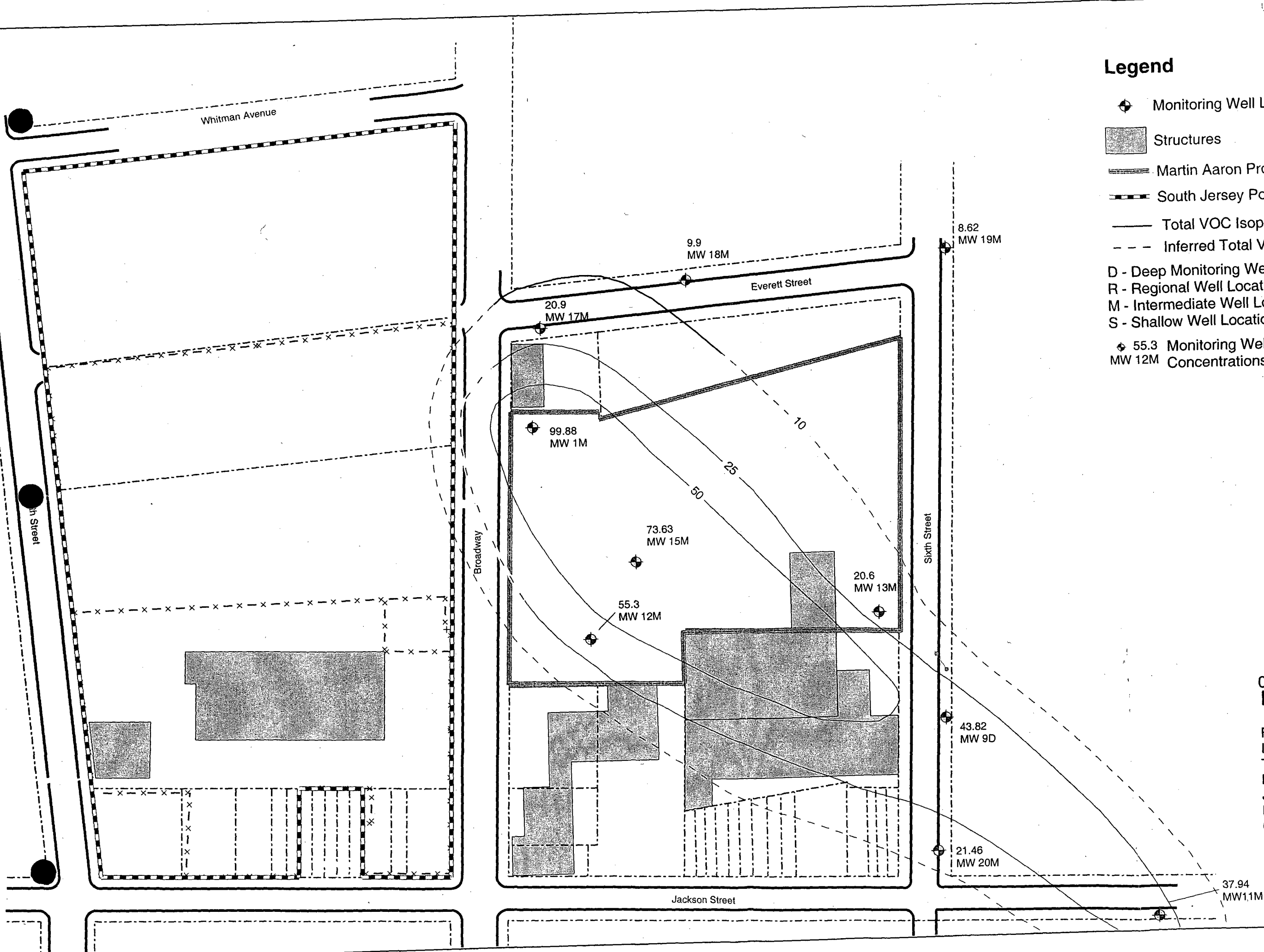






Legend

- Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Total VOC Isopleth in ug/L
- Inferred Total VOC Isopleth in ug/L
- D - Deep Monitoring Well Locations
- R - Regional Well Locations
- M - Intermediate Well Locations
- S - Shallow Well Locations
- 55.3 Monitoring Well with Total VOC MW 12M Concentrations in ug/L



0 25 50 100 Feet

Figure 6-3
Isopleth Map of
Total VOC Concentrations in
Middle Upper PRM Aquifer
June 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004

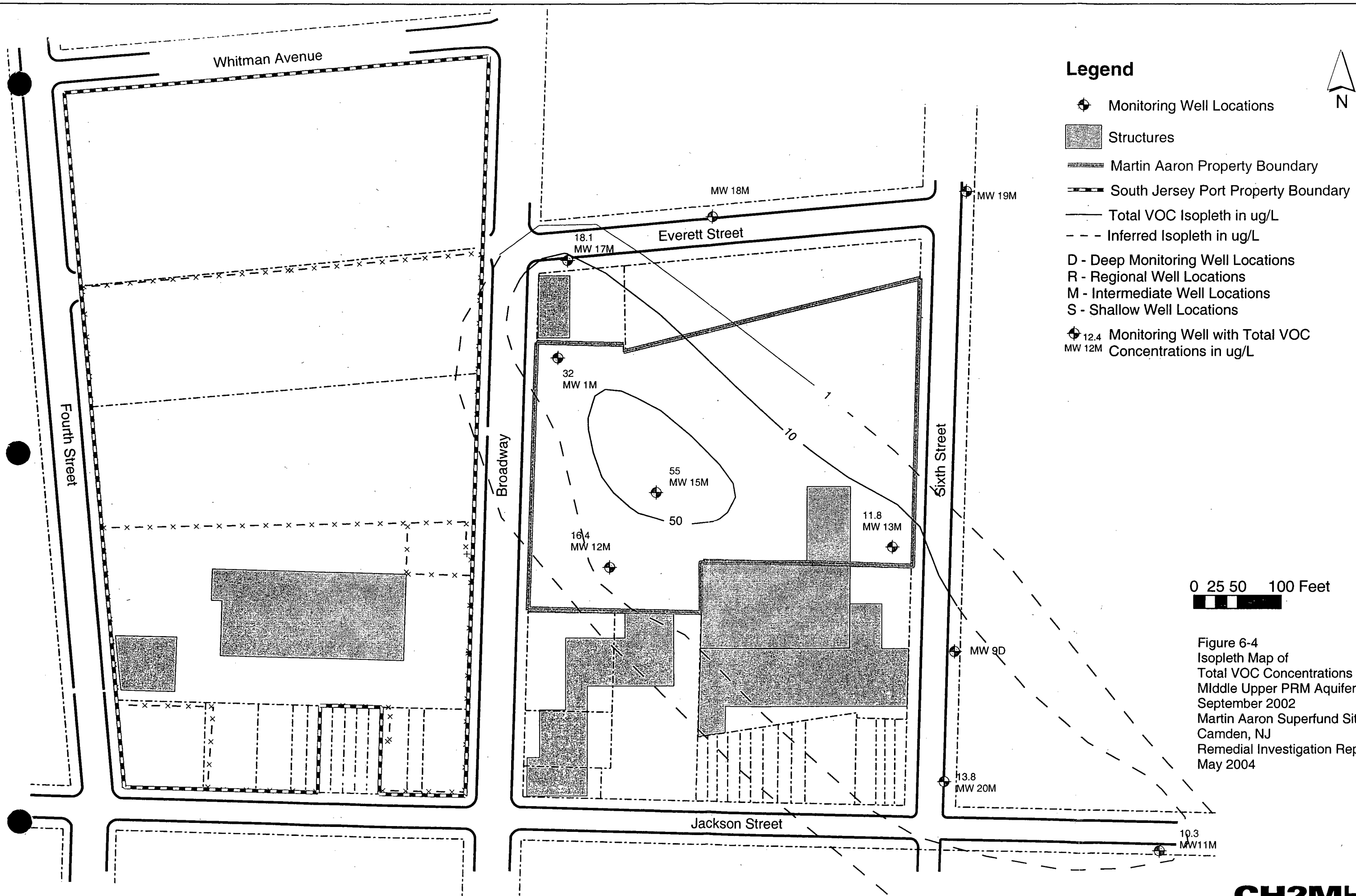
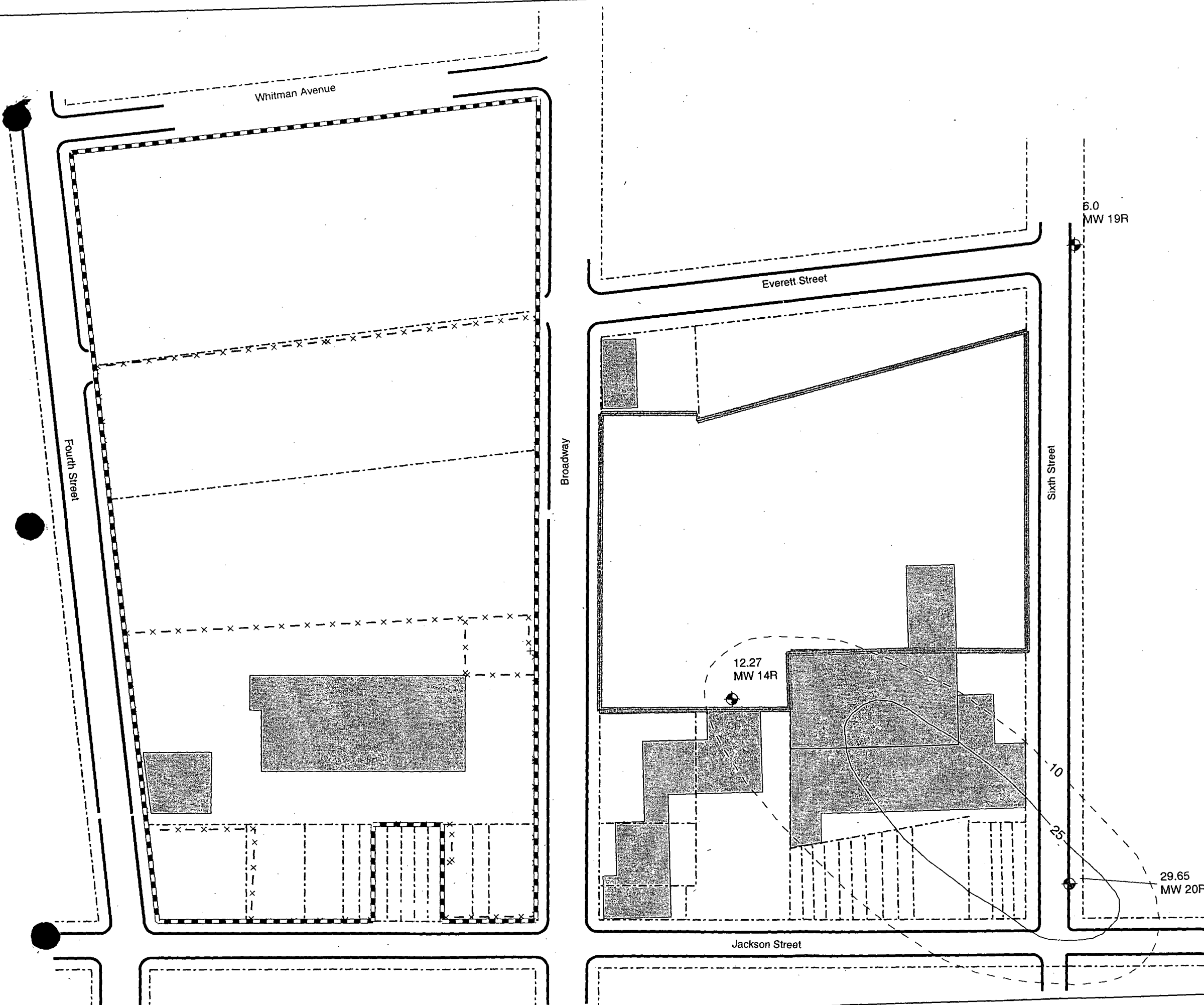


Figure 6-4
Isopleth Map of
Total VOC Concentrations in the
Middle Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend








- Monitoring Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Total VOC Isopleth in ug/L
- Inferred Isopleth in ug/L
- D - Deep Monitoring Well Locations
- R - Regional Well Locations
- M - Intermediate Well Locations
- S - Shallow Well Locations
- 55.3 Monitoring Well with Total VOC
MW 12M Concentrations in ug/L

0 25 50 100 Feet

Figure 6-5
Isopleth Map of
Total VOC Concentrations in Isolated Sand
Unit Between Upper and Middle PRM Aquifers
June 2002
Intermediate Upper PRM Aquifer
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



Legend

-  Monitoring Well Locations
-  Structures
-  Martin Aaron Property Boundary
-  South Jersey Port Property Boundary
-  Total VOC Isopleth
-  Inferred Total VOC Isopleth
- D - Deep Monitoring Well Locations
- R - Regional Well Locations
- M - Intermediate Well Locations
- S - Shallow Well Locations
-  55.3 Monitoring Well with Total VOC
MW 12M Concentrations in ug/L

0 25 50 100 Feet


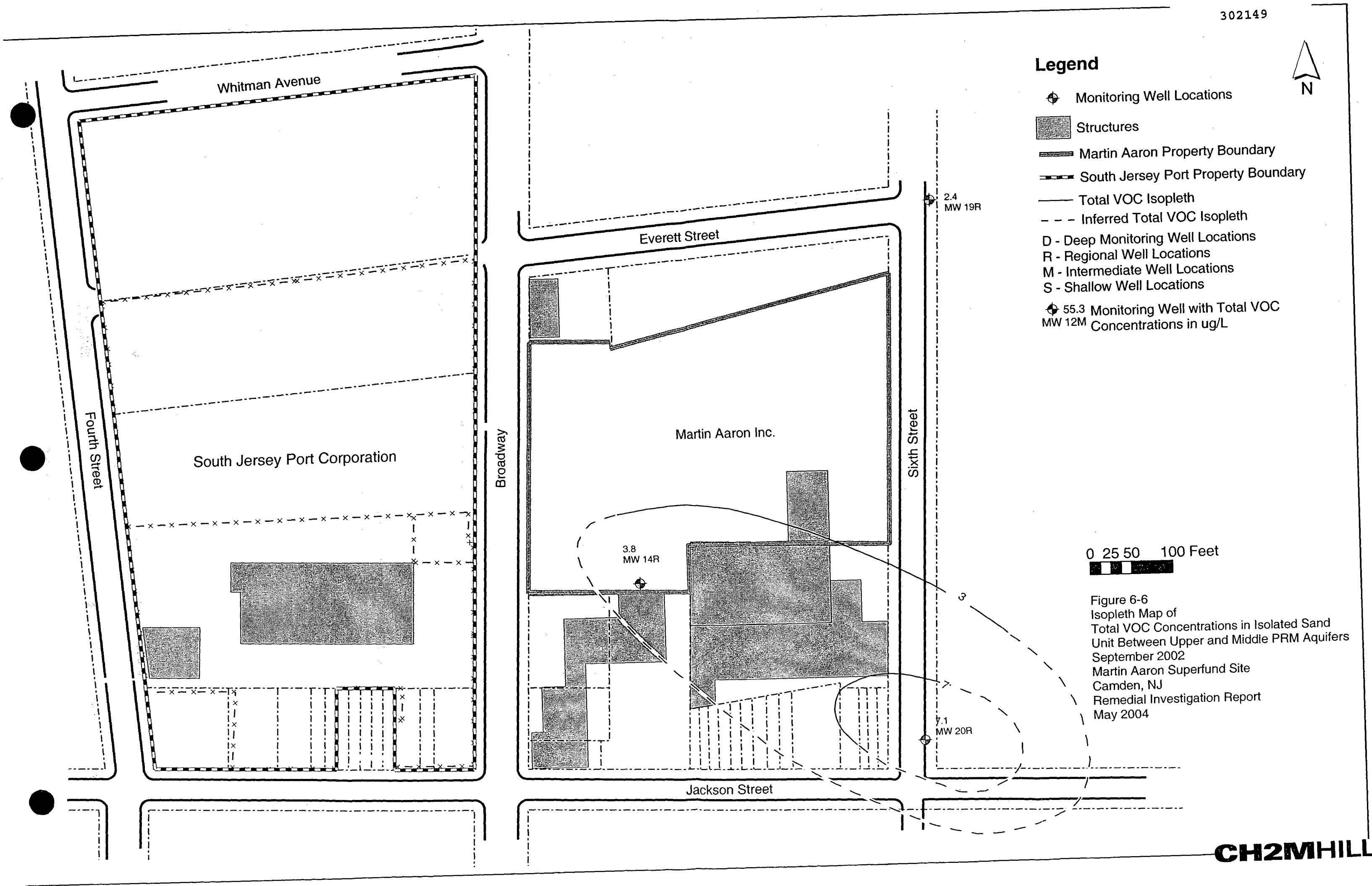
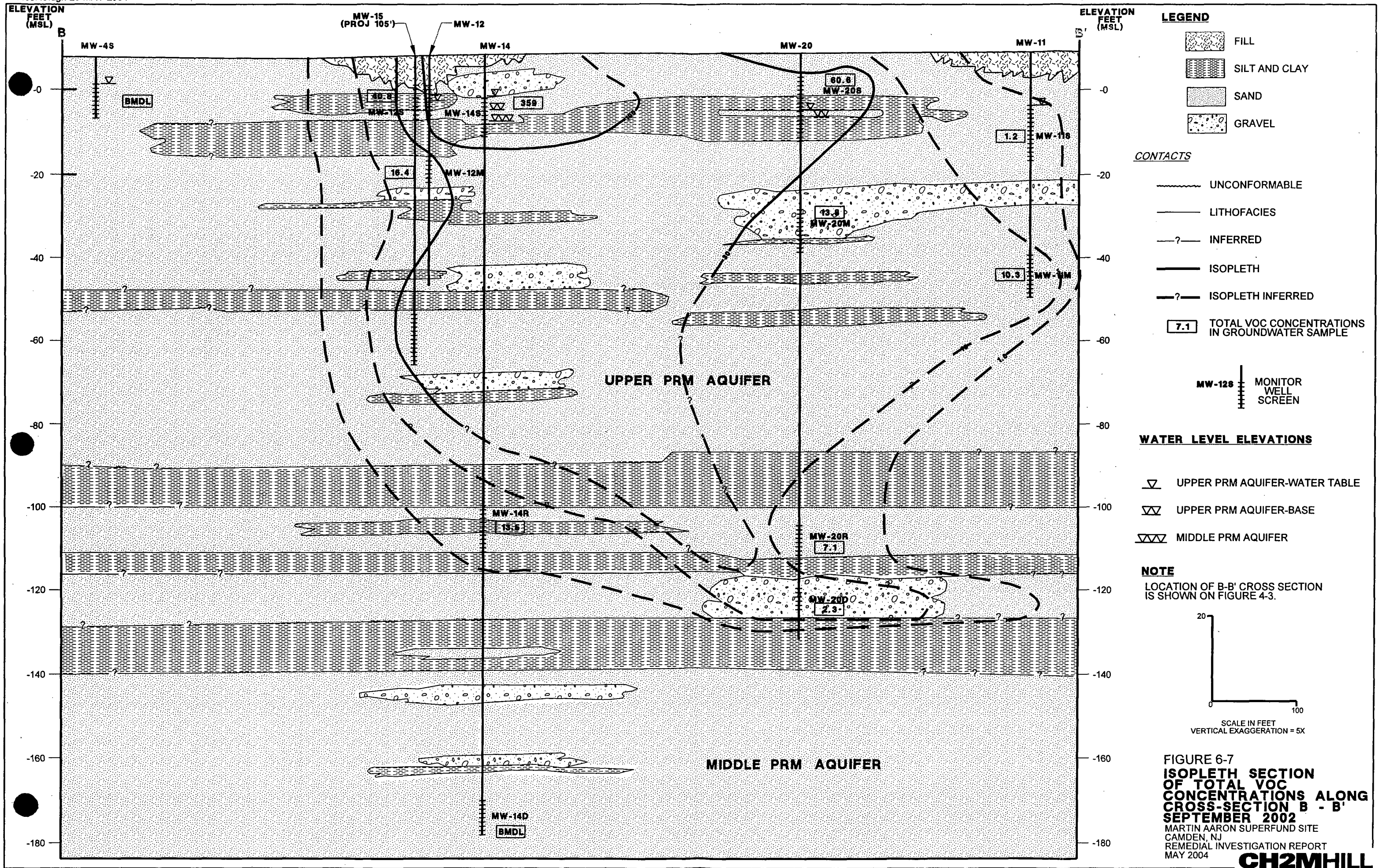


Figure 6-6
Isopleth Map of
Total VOC Concentrations in Isolated Sand
Unit Between Upper and Middle PRM Aquifers
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004





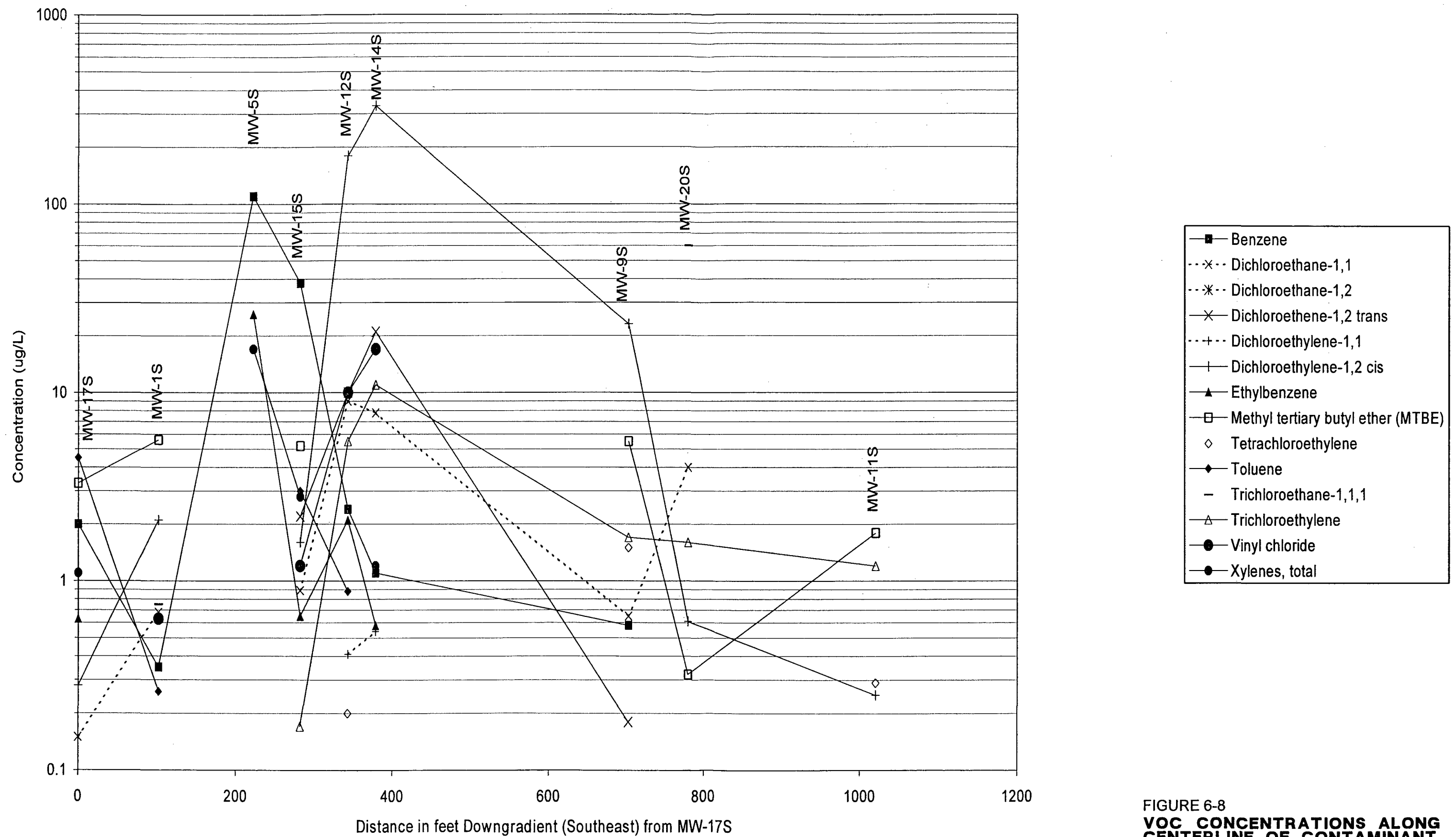


FIGURE 6-8
**VOC CONCENTRATIONS ALONG
 CENTERLINE OF CONTAMINANT
 PLUME IN THE SURFICIAL UPPER PRM
 SEPTEMBER 2002**
 MARTIN AARON SUPERFUND SITE
 CAMDEN, NJ
 REMEDIAL INVESTIGATION REPORT
 MAY 2004

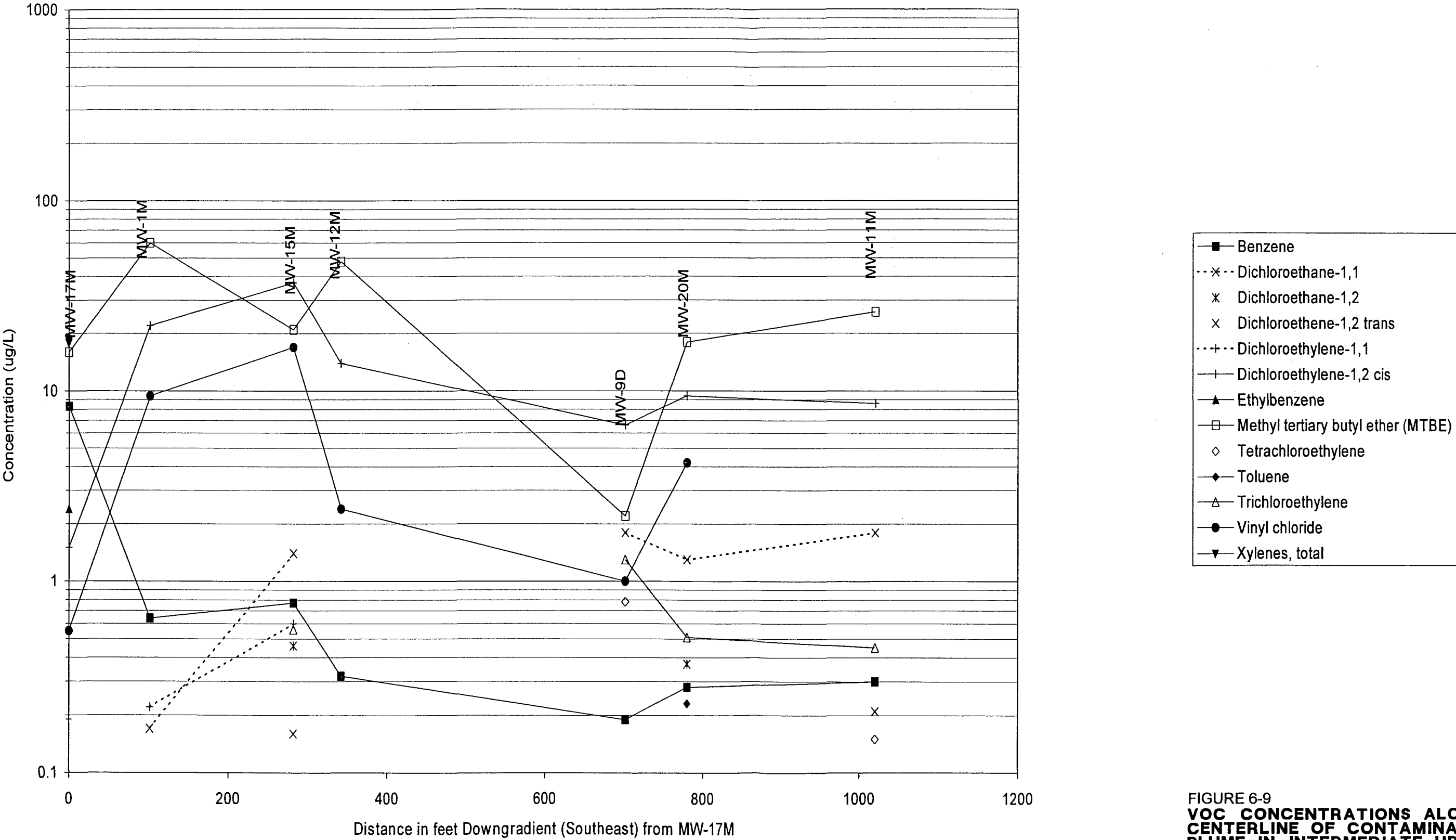


FIGURE 6-9
VOC CONCENTRATIONS ALONG
CENTERLINE OF CONTAMINANT
PLUME IN INTERMEDIATE UPPER PRM
SEPTEMBER 2002
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

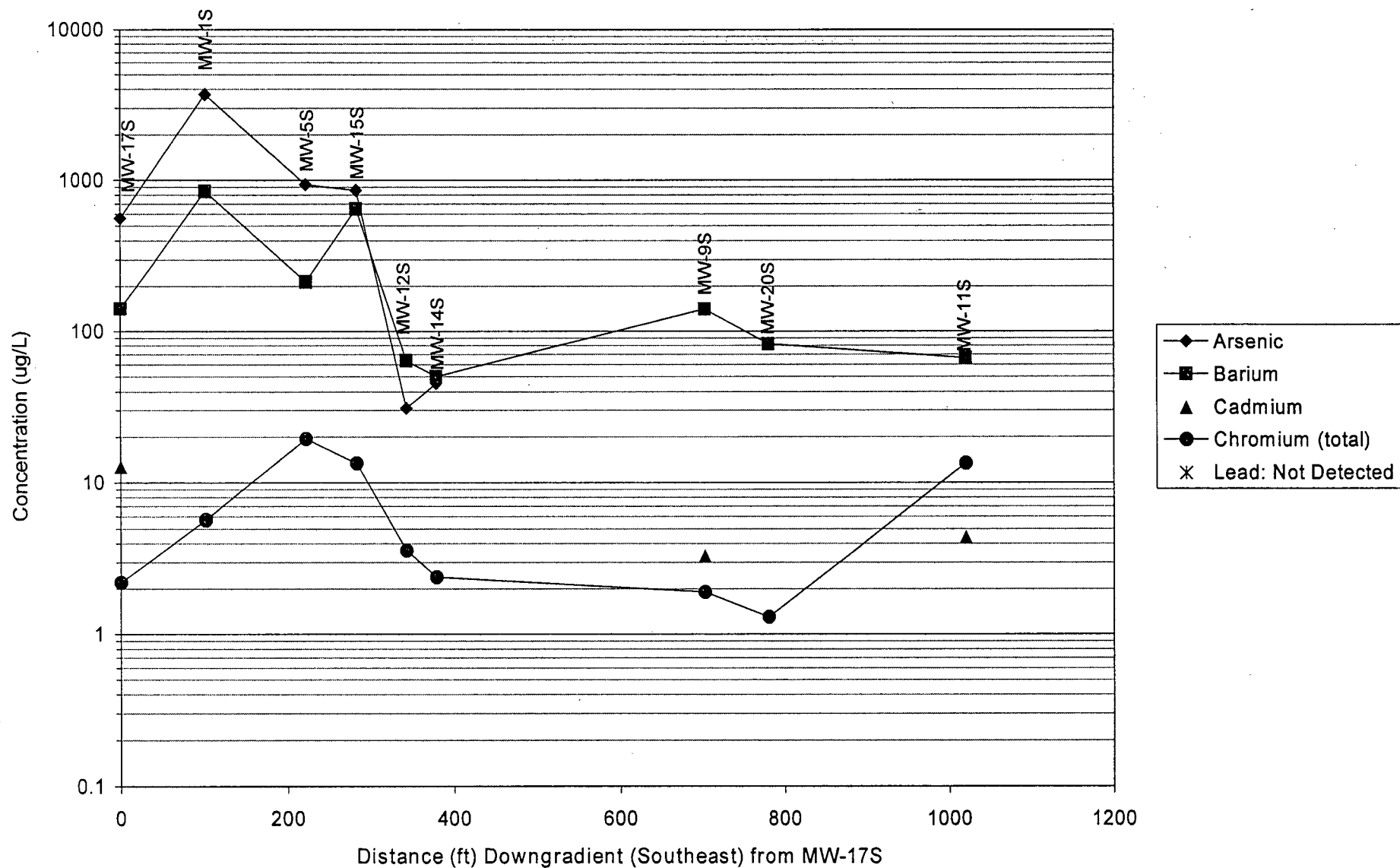


FIGURE 6-10
**DISSOLVED METAL CONCENTRATIONS
 ALONG CENTERLINE OF PLUME IN
 SURFICIAL UPPER PRM AQUIFER**
 MARTIN AARON SUPERFUND SITE
 CAMDEN, NJ
 REMEDIAL INVESTIGATION REPORT
 MAY 2004

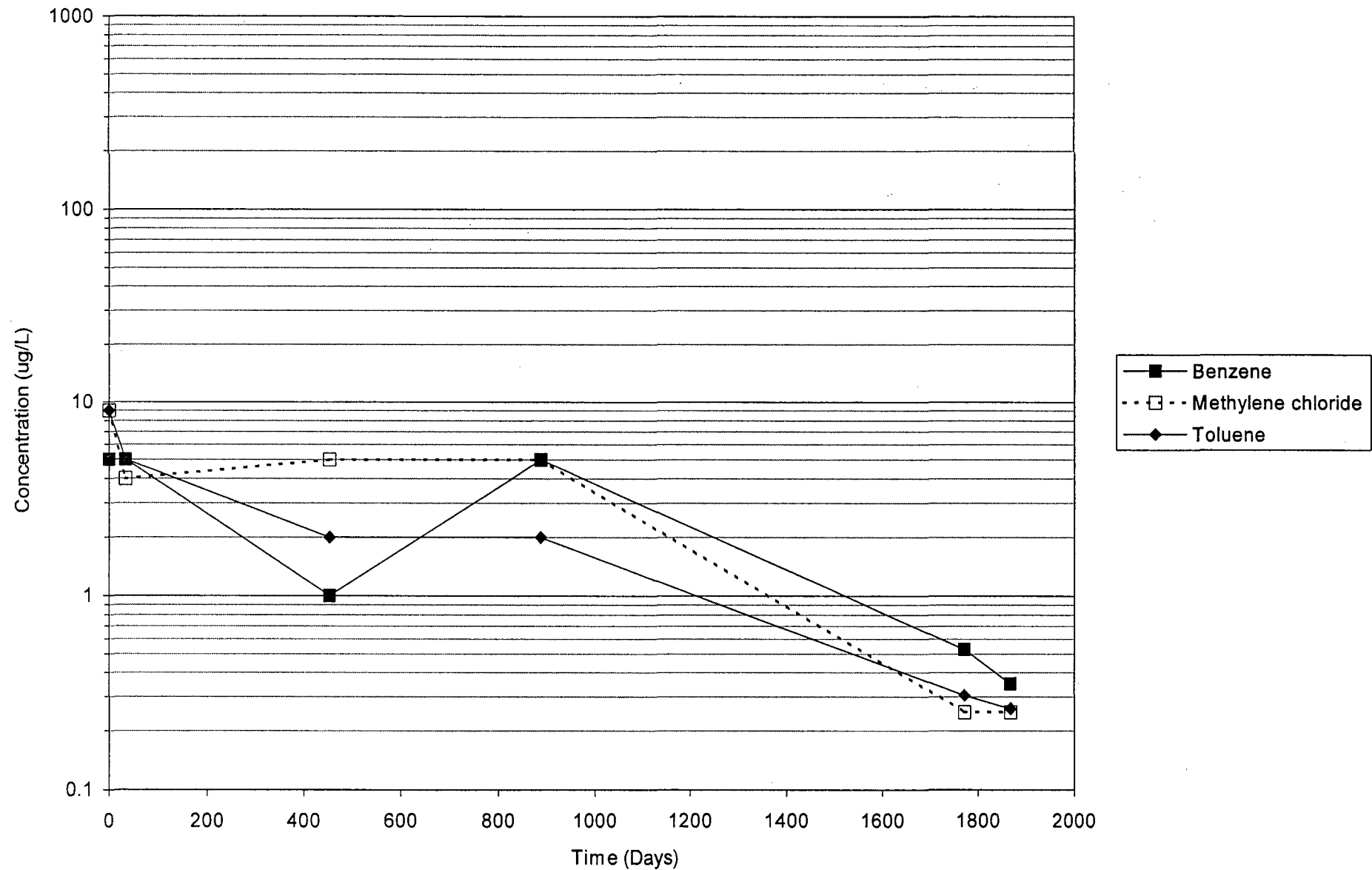


FIGURE 6-11
VOC CONCENTRATIONS WITH TIME
IN MW-1S (09/1997-09/2002)
SURFICIAL UPPER PRM AQUIFER
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

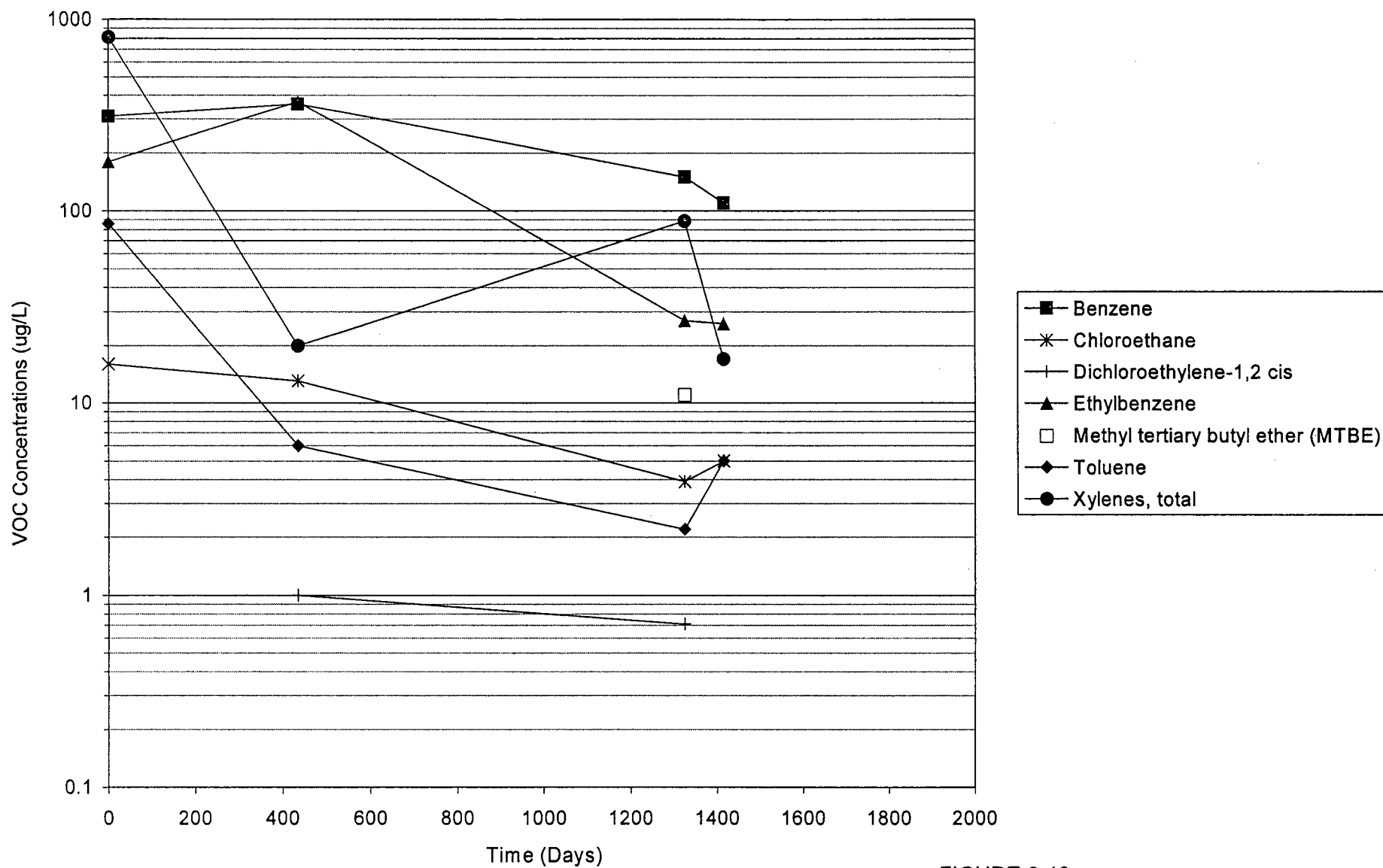


FIGURE 6-12
**VOC CONCENTRATIONS WITH TIME
IN MW-5S (11/1998-09/2002)**
SURFICIAL UPPER PRM AQUIFER
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

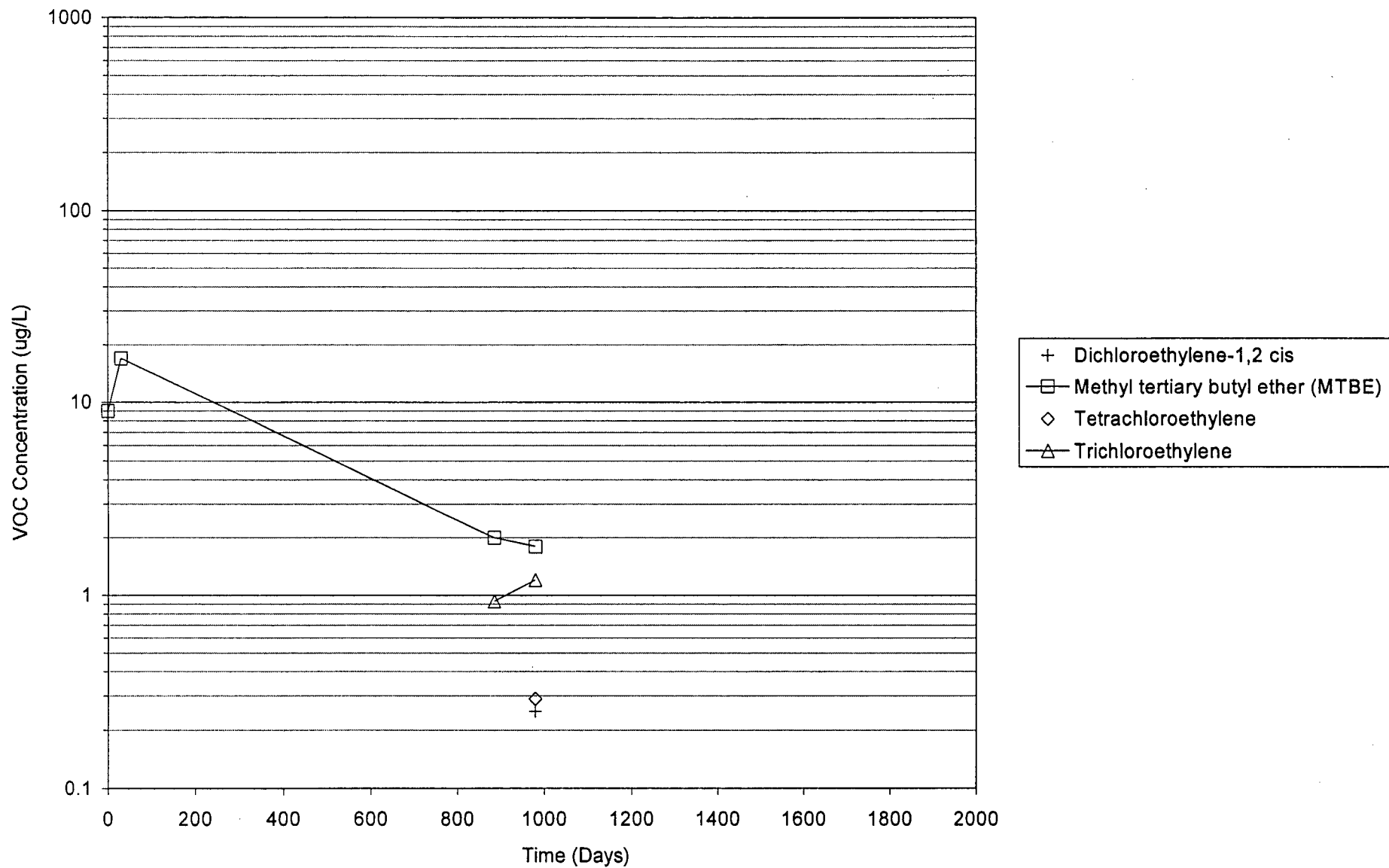


FIGURE 6-13
VOC CONCENTRATIONS VS. TIME
IN MW-11S (01/2000-09/2002)
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
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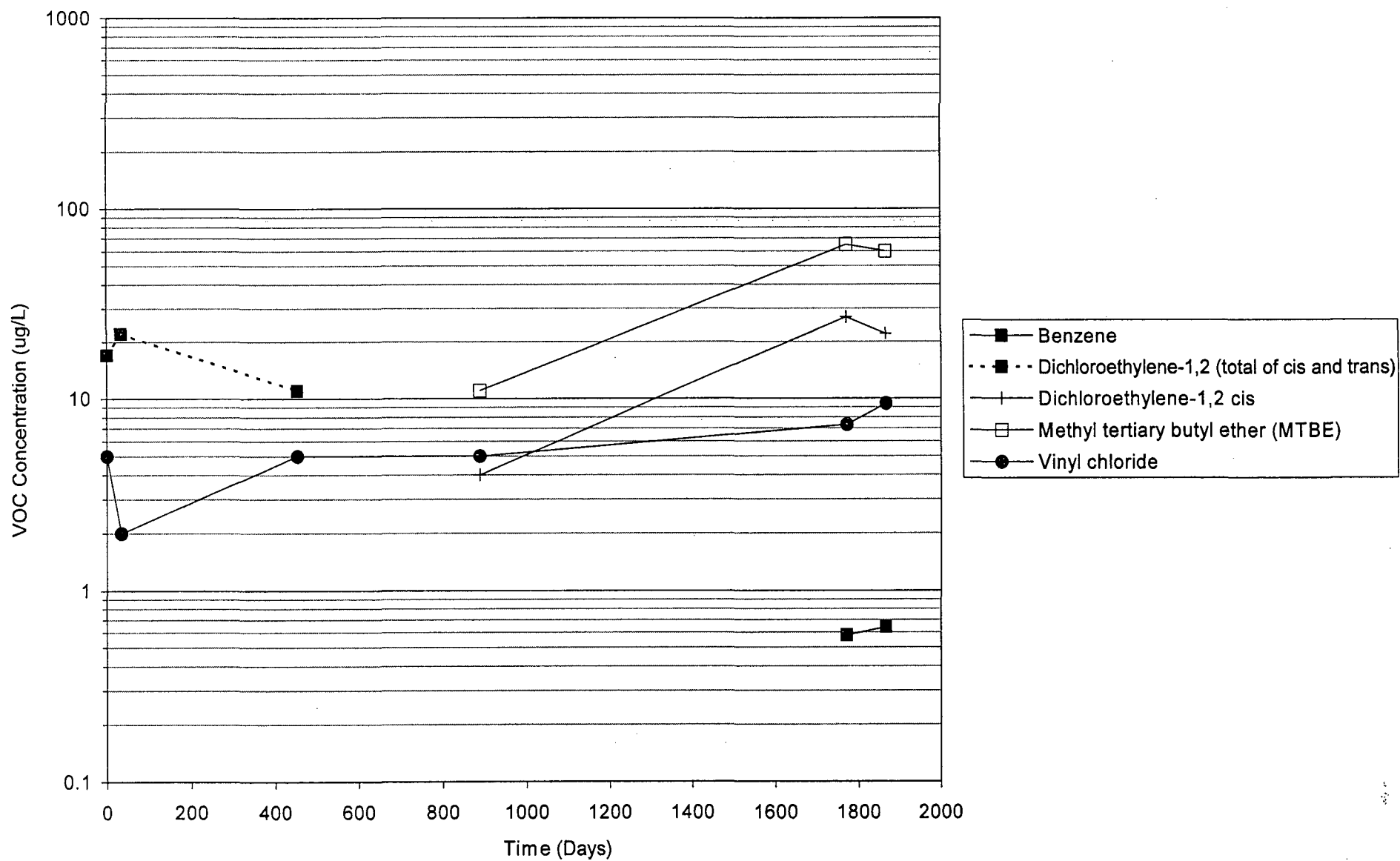


FIGURE 6-14
VOC CONCENTRATIONS WITH TIME
IN MW-1M (08/1997-09/2002)
INTERMEDIATE UPPER PRM AQUIFER
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

CH2MHILL

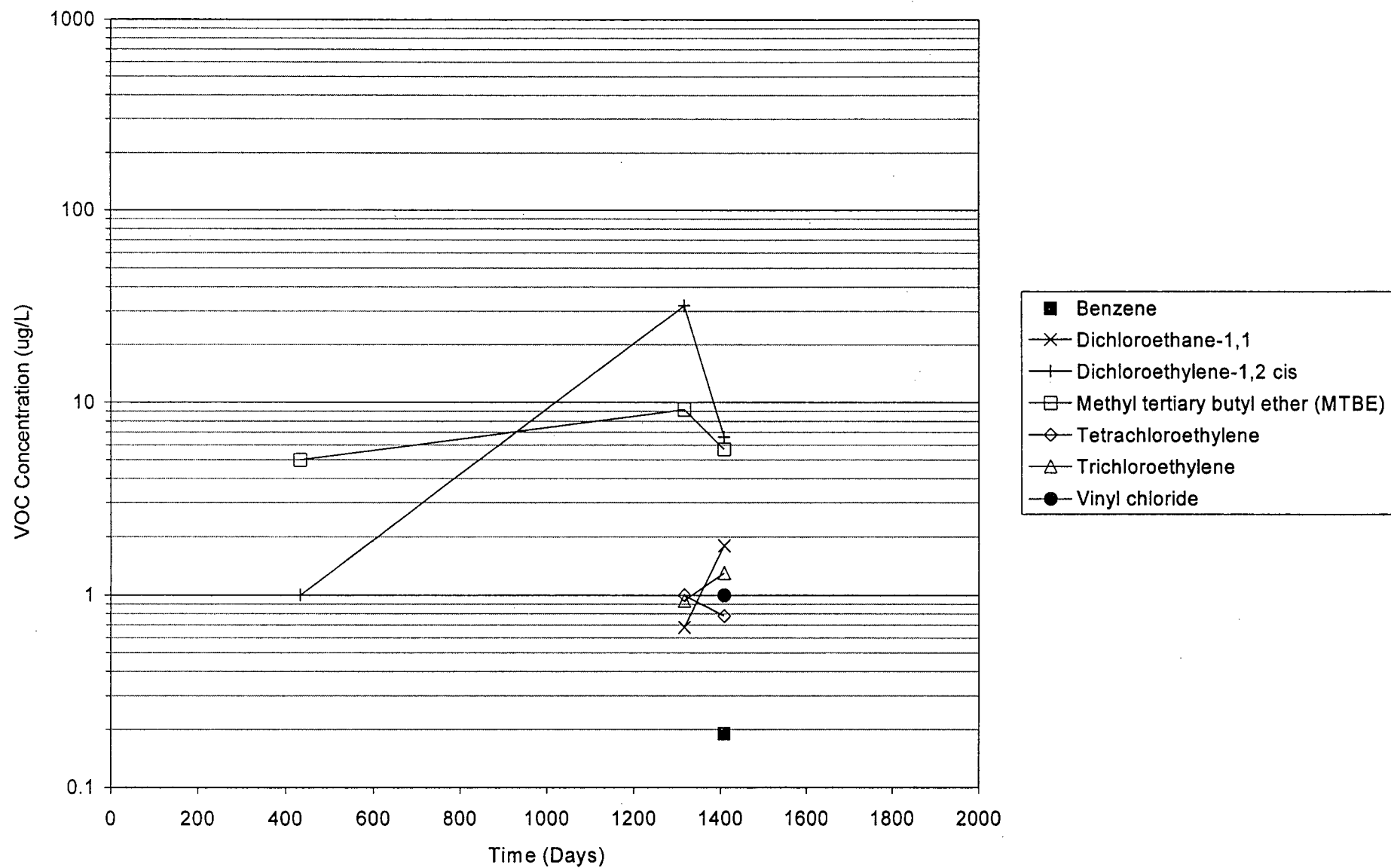
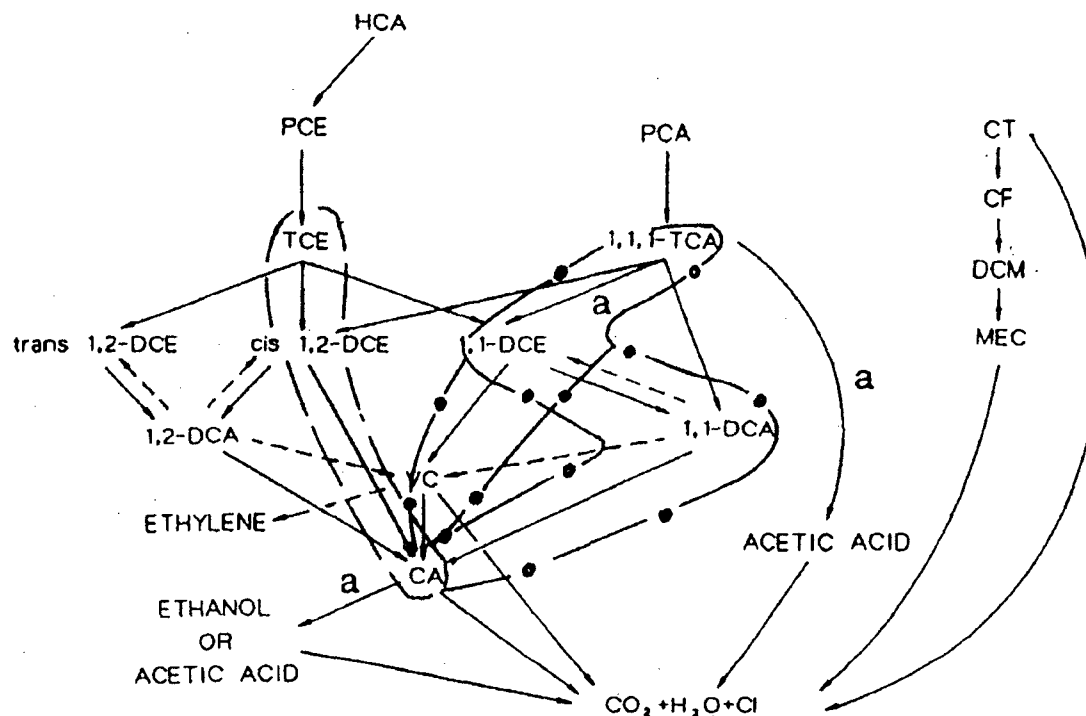


FIGURE 6-15
**VOC CONCENTRATIONS WITH
TIME IN MW-9D (11/1998-09/2002)**
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004



HCA - HEXACHLOROETHANE (CCl_3CCl_3)
 PCA - TETRACHLOROETHANE ($\text{CHCl}_2\text{CHCl}_2$)
 PCE - TETRACHLOROETHYLENE ($\text{CCl}_2=\text{CCl}_2$)
 1,1,1-TCA - 1,1,1-TRICHLOROETHANE (CH_3CCl_3)
 TCE - TRICHLOROETHYLENE ($\text{CHCl}=\text{CCl}_2$)
 1,1-DCA - 1,1-DICHLOROETHANE (CH_3CHCl_2)
 1,2-DCA - 1,2-DICHLOROETHANE ($\text{CH}_2\text{Cl}-\text{CH}_2\text{Cl}$)
 1,1-DCE - 1,1-DICHLOROETHYLENE ($\text{CH}_2=\text{CCl}_2$)
 cis 1,2-DCE - cis 1,2-DICHLOROETHYLENE (cis $\text{CHCl}=\text{CHCl}$)
 trans 1,2-DCE - trans 1,2-DICHLOROETHYLENE (trans $\text{CHCl}=\text{CHCl}$)
 VC - VINYL CHLORIDE ($\text{CH}_2=\text{CHCl}$)
 CA - CHLOROETHANE ($\text{CH}_3-\text{CH}_2\text{Cl}$)
 CT - CARBON TETRACHLORIDE (CCl_4)
 CF - CHLOROFORM (CHCl_3)
 DCM - DICHLOROMETHANE (CH_2Cl_2)
 MEC - METHYL CHLORIDE (CH_3Cl)
 ETHANOL - ($\text{CH}_3\text{CH}_2\text{OH}$)
 ACETIC ACID - (CH_3COOH)
 ETHYLENE - ($\text{CH}_2=\text{CH}_2$)

NOTES:

(—————)

PRIMARY TRANSFORMATION PATHWAY

(- - - - -)

SECONDARY TRANSFORMATION PATHWAY

(a)

INDICATES ABIOTIC CHEMICAL TRANSFORMATION OTHER ARROWS REPRESENTS BIOLOGICAL TRANSFORMATIONS

(—————)

PRESUMED TRANSFORMATION PATHWAY FOR PCE & TCE

(— • — • —)

PRESUMED TRANSFORMATION PATHWAYS FOR 1,1,1-TCA

FIGURE 6-16

CHEMICAL AND BIOLOGICAL TRANSFORMATION PATHWAYS FOR CHLORINATED ALIPHATIC HYDROCARBONS

MARTIN AARON SUPERFUND SITE
 CAMDEN, NJ
 REMEDIAL INVESTIGATION REPORT
 MAY 2004

SOURCE:
 (BARBEE, 1994 AND MODIFIED
 BY NYER ET. AL. 1996)

CH2MHILL

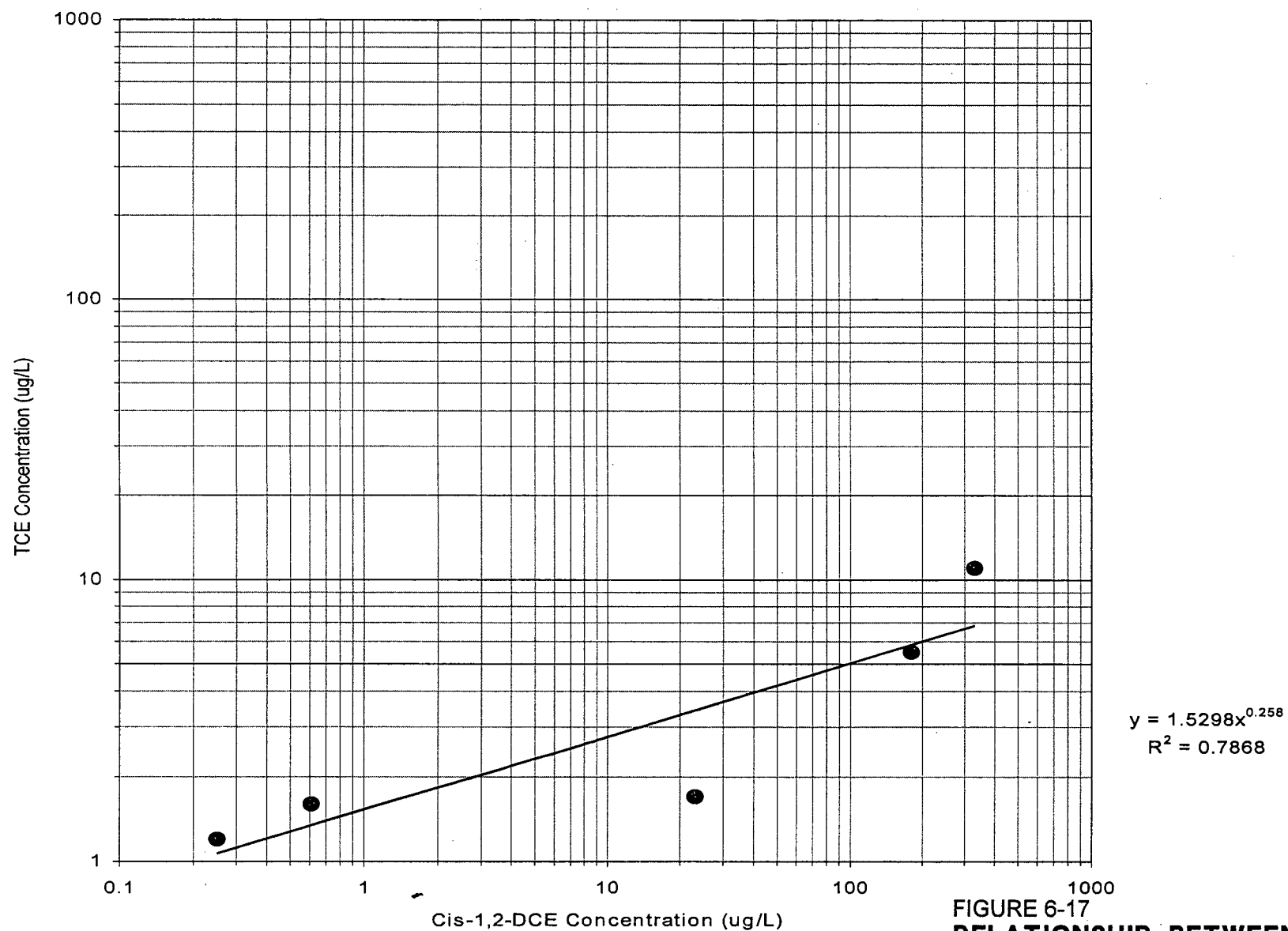


FIGURE 6-17

**RELATIONSHIP BETWEEN TCE AND
CIS-1,2-DCE CONCENTRATIONS AT
MARTIN AARON SURFICIAL UPPER
PRM AQUIFER - SEPTEMBER 2002**
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

CH2MHILL

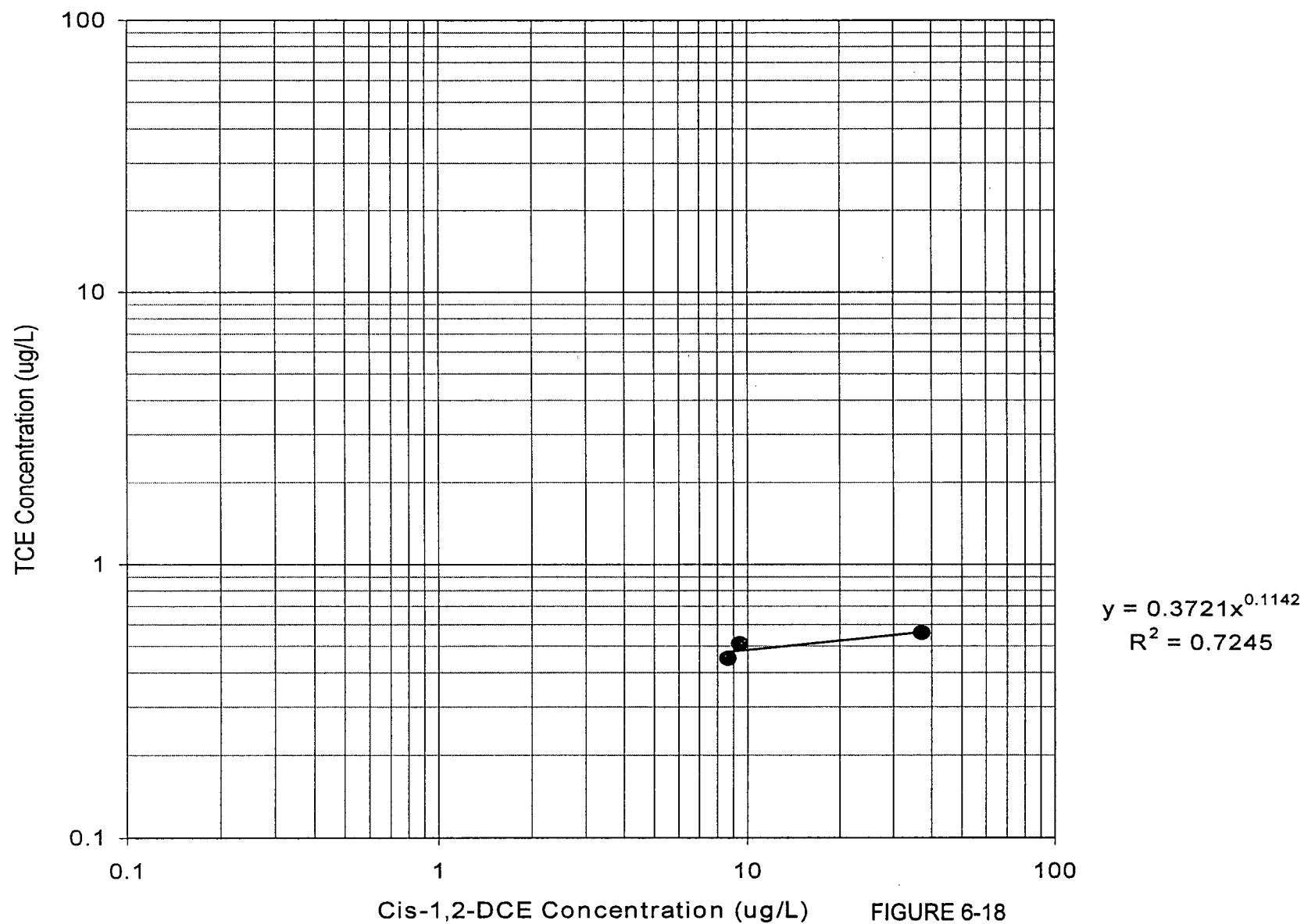


FIGURE 6-18
**RELATIONSHIP BETWEEN TCE AND
CIS-1,2-DCE CONCENTRATIONS AT
MARTIN AARON INTERMEDIATE UPPER
PRM AQUIFER - SEPTEMBER 2002**
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
REMEDIAL INVESTIGATION REPORT
MAY 2004

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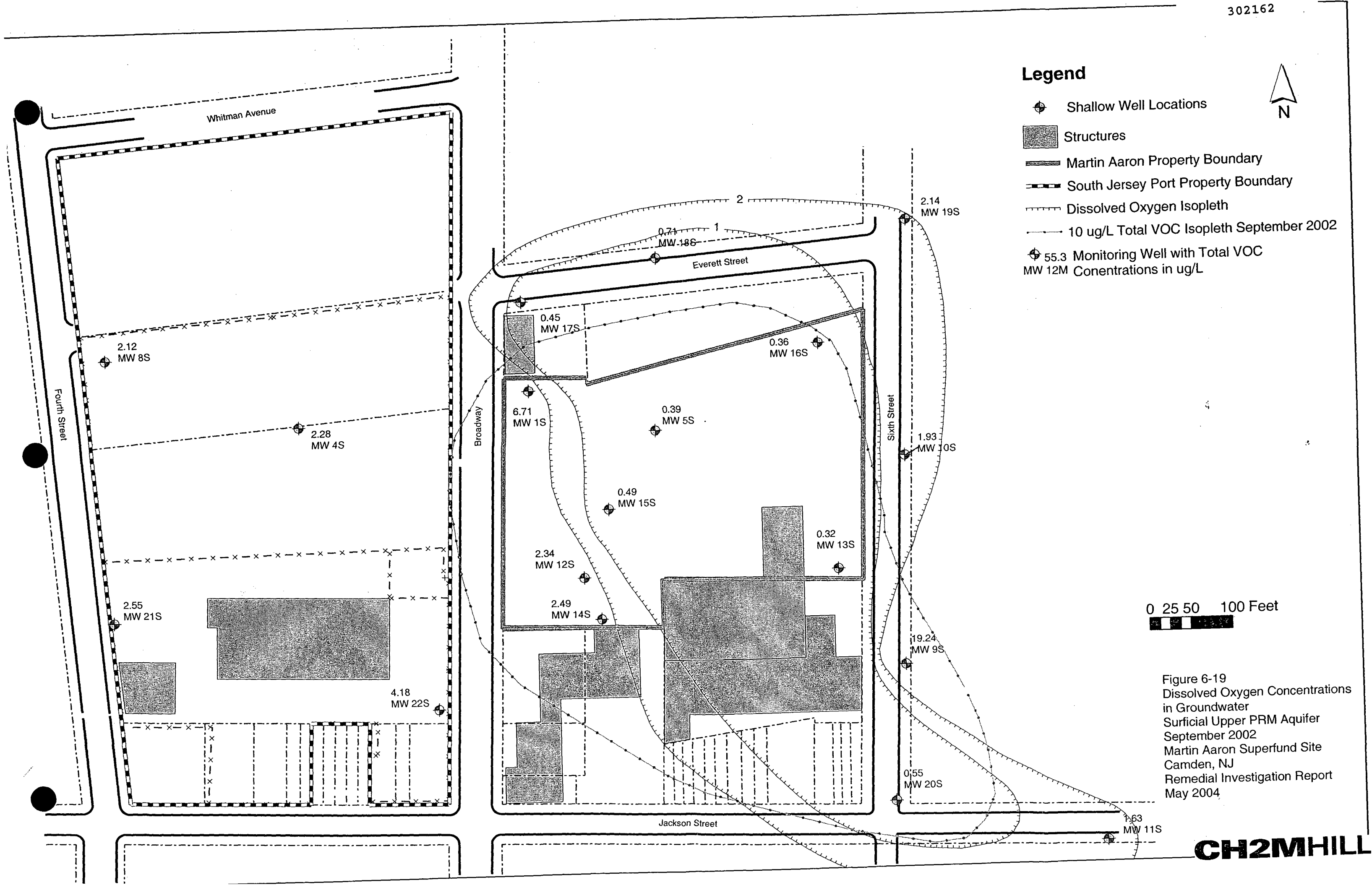
Legend

- Shallow Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Dissolved Oxygen Isopleth
- 10 ug/L Total VOC Isopleth September 2002
- 55.3 Monitoring Well with Total VOC MW 12M Concentrations in ug/L



0 25 50 100 Feet

Figure 6-19
Dissolved Oxygen Concentrations
in Groundwater
Surficial Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
Remedial Investigation Report
May 2004



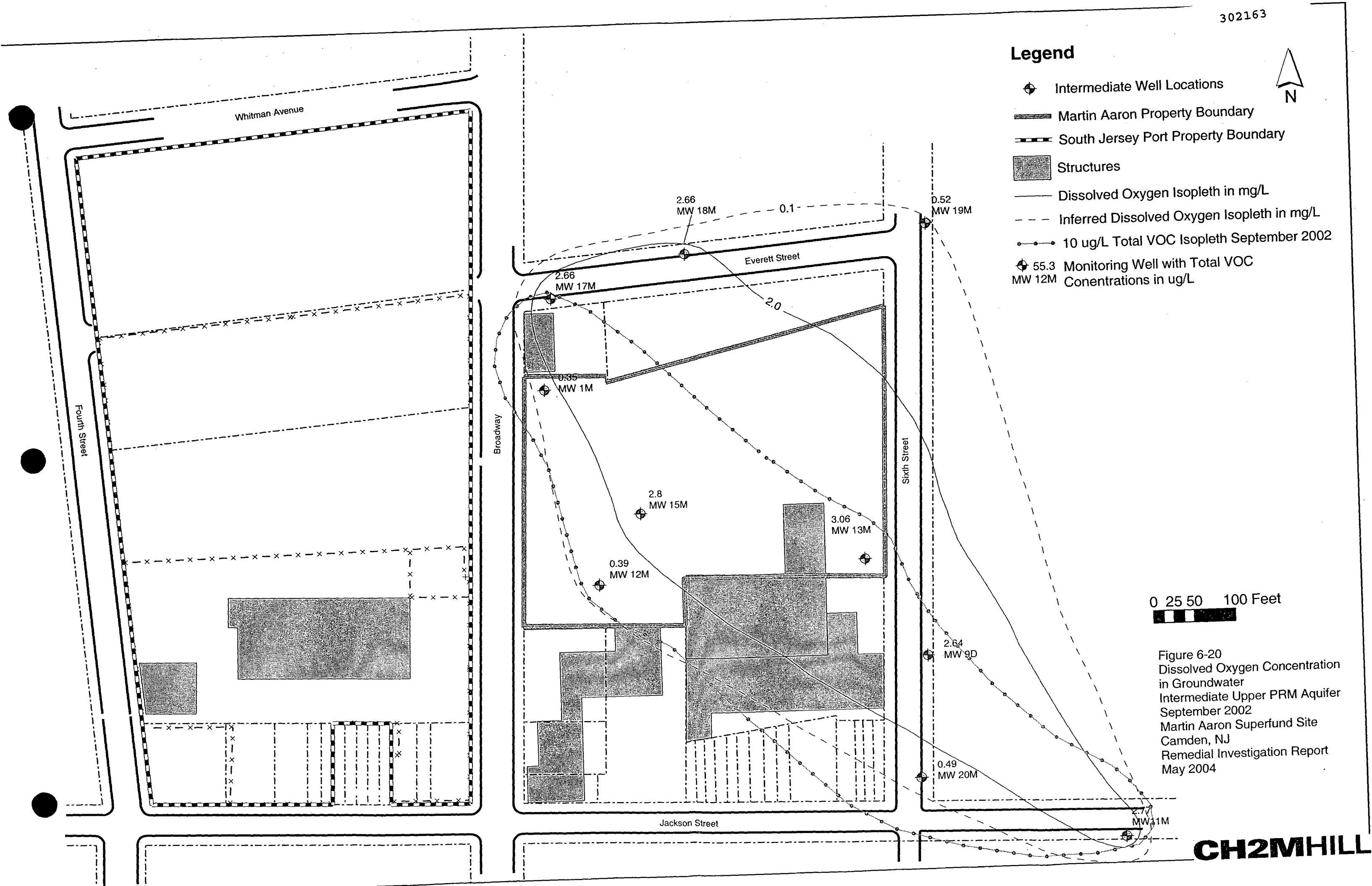
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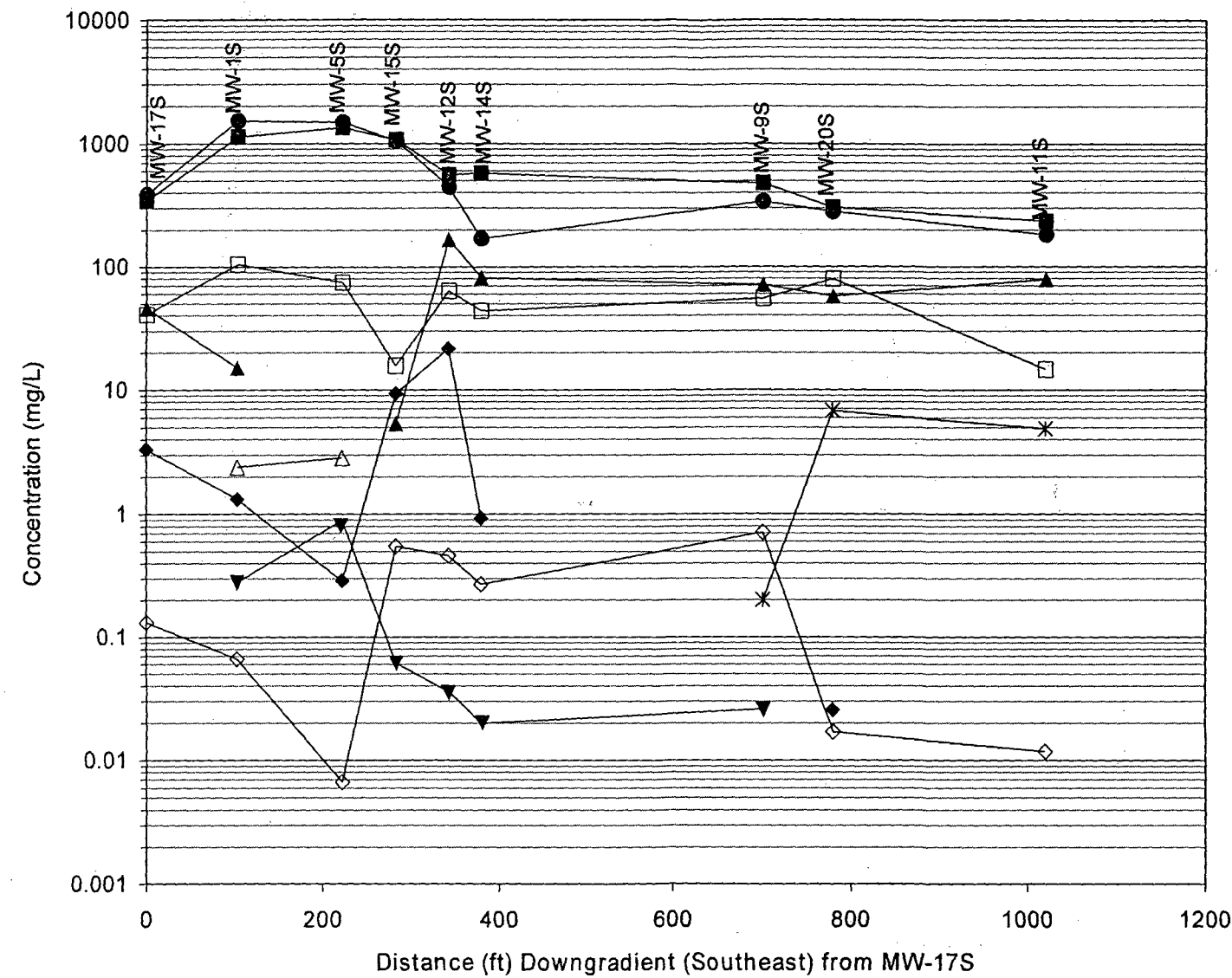
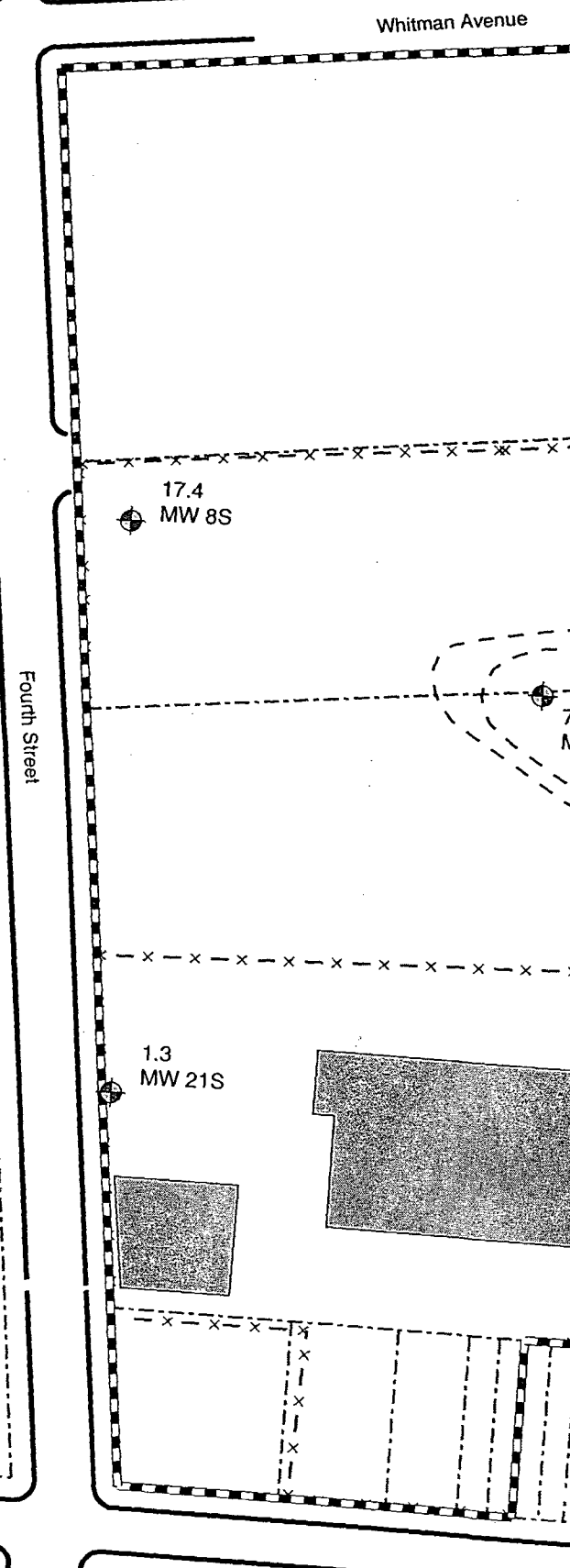
- Intermediate Well Locations
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- Structures
- Dissolved Oxygen Isopleth in mg/L
- Inferred Dissolved Oxygen Isopleth in mg/L
- 10 ug/L Total VOC Isopleth September 2002
- 55.3 Monitoring Well with Total VOC Concentrations in ug/L



0 25 50 100 Feet

Figure 6-20
Dissolved Oxygen Concentration
in Groundwater
Intermediate Upper PRM Aquifer
September 2002
Martin Aaron Superfund Site
Camden, NJ
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Note: Iron was not analyzed at MW-17S, MW-9S or MW-20S.

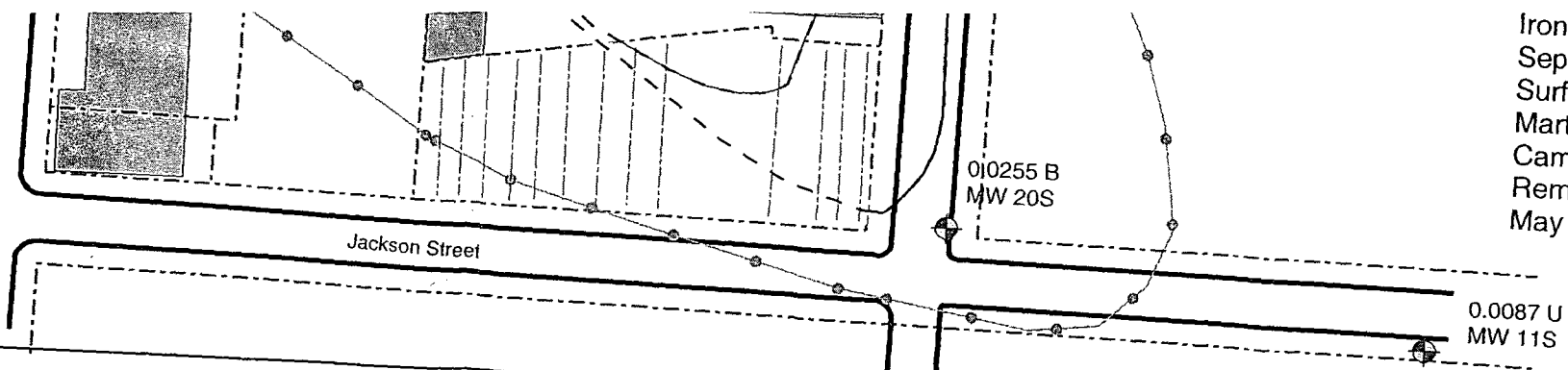
- * Nitrate
- Nitrite (Not detected)
- ▲ Sulfate
- △ Sulfide
- Iron (Not detected)
- ◆ Iron (Dissolved)
- ◇ Manganese (Dissolved)
- ▼ Methane
- Alkalinity, Total as CaCO₃
- Carbon dioxide
- Chloride

FIGURE 6-21
GEOCHEMICALS PARAMETERS
ALONG CENTERLINE OF PLUME IN
SURFICIAL UPPER PRM AQUIFER
MARTIN AARON SUPERFUND SITE
CAMDEN, NJ
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boundary
rty Boundary
th September 2002
ng/L
iciated blank
in quantity
the reporting limit

0 Feet

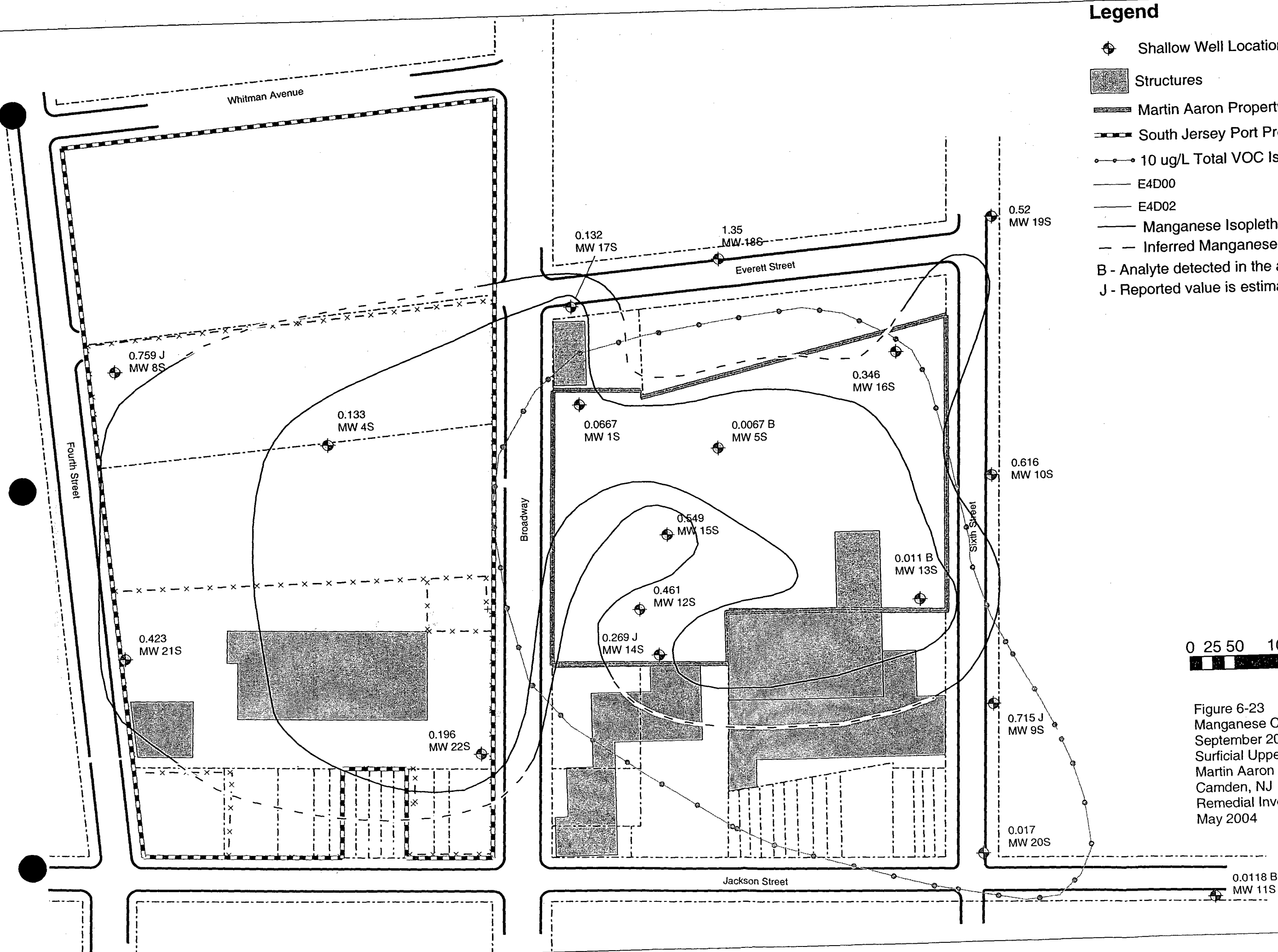


Iron Concentrations in Groundwater
September 2002
Surficial Upper PRM Aquifer
Martin Aaron Superfund Site
Camden, NJ
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0.0087 U
MW 11S

Legend

- Shallow Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- 10 ug/L Total VOC Isopleth September 2002
- E4D00
- E4D02
- Manganese Isopleth in mg/L
- Inferred Manganese Isopleth in mg/L
- B - Analyte detected in the associated blank
- J - Reported value is estimated in quantity



0 25 50 100 Feet

Figure 6-23
Manganese Concentrations in Groundwater
September 2002
Surficial Upper PRM Aquifer
Martin Aaron Superfund Site
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Legend

- Shallow Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- 10 ug/L Total VOC Isopleth September 2002
- Alkalinity Isopleth in mg/L

Whitman Avenue

456
MW 18S

Everett Street

290
MW 17S

460
MW 19S

658
MW 8S

260
MW 4S

276
MW 16S

1520
MW 1S

1490
MW 5S

1050
MW 15S

446
MW 12S

1300
MW 13S

486
MW 10S

Fourth Street

Broadway

Sixth Street

460
MW 21S

230
MW 22S

170
MW 14S

0 25 50 100 Feet



Figure 6-24
Alkalinity Concentrations in Groundwater
September 2002
Surficial Upper PRM Aquifer
Martin Aaron Superfund Site
Camden, NJ
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Jackson Street

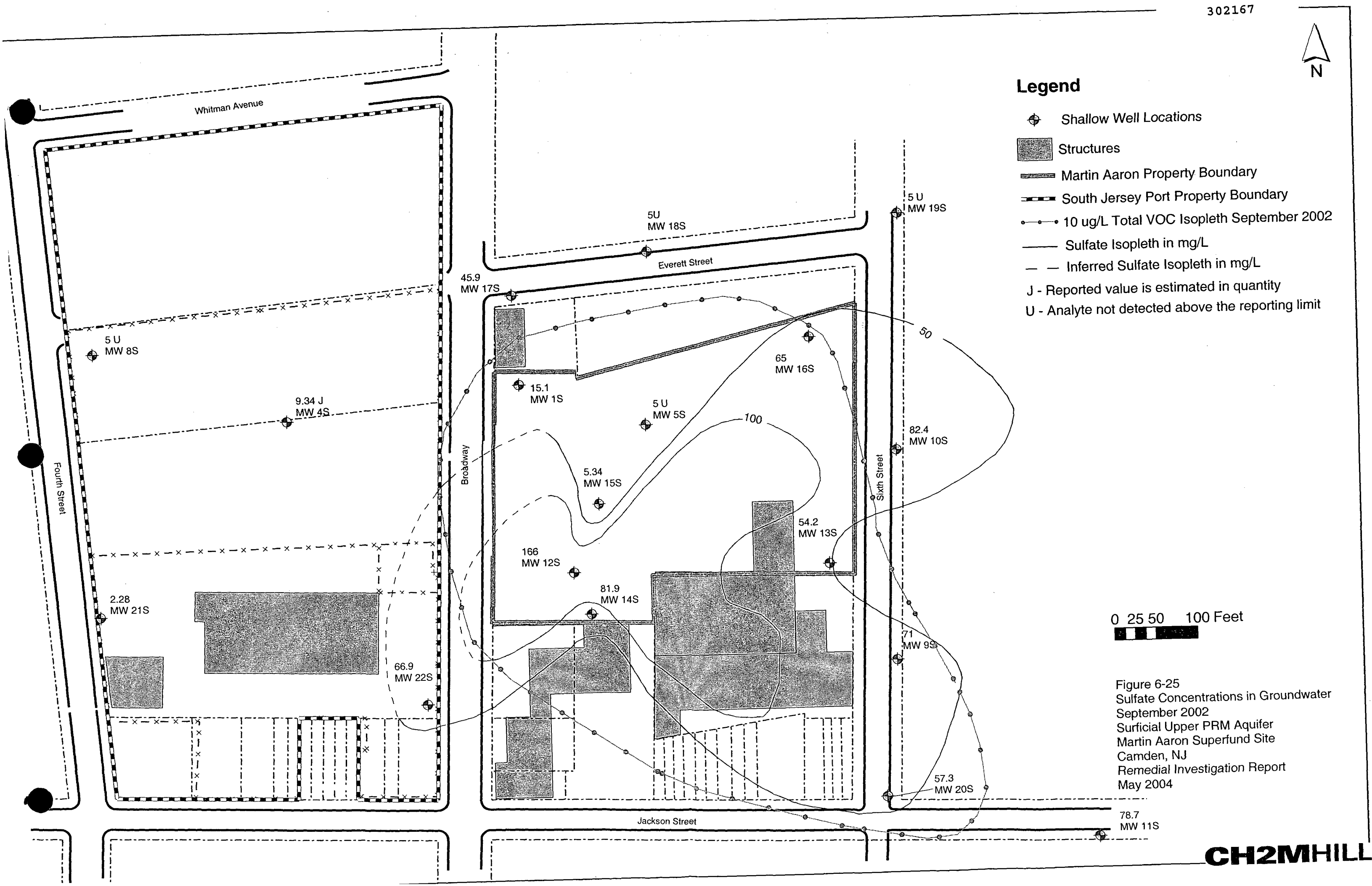
280
MW 20S

182
MW 11S



Legend

- Shallow Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- 10 ug/L Total VOC Isopleth September 2002
- Sulfate Isopleth in mg/L
- Inferred Sulfate Isopleth in mg/L
- J - Reported value is estimated in quantity
- U - Analyte not detected above the reporting limit



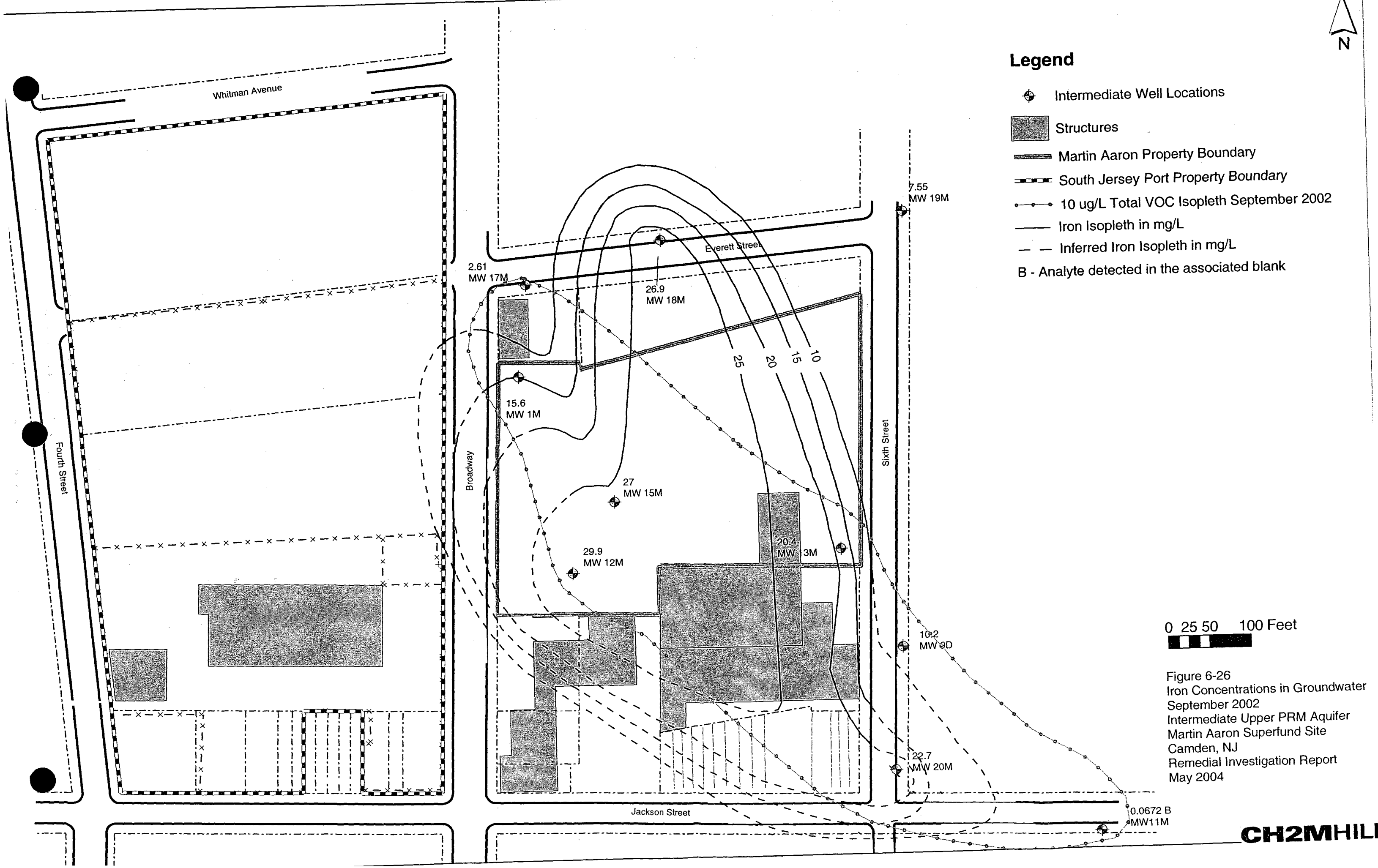
0 25 50 100 Feet

Figure 6-25
 Sulfate Concentrations in Groundwater
 September 2002
 Surficial Upper PRM Aquifer
 Martin Aaron Superfund Site
 Camden, NJ
 Remedial Investigation Report
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Legend

- Intermediate Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- 10 ug/L Total VOC Isopleth September 2002
- Iron Isopleth in mg/L
- Inferred Iron Isopleth in mg/L
- B - Analyte detected in the associated blank



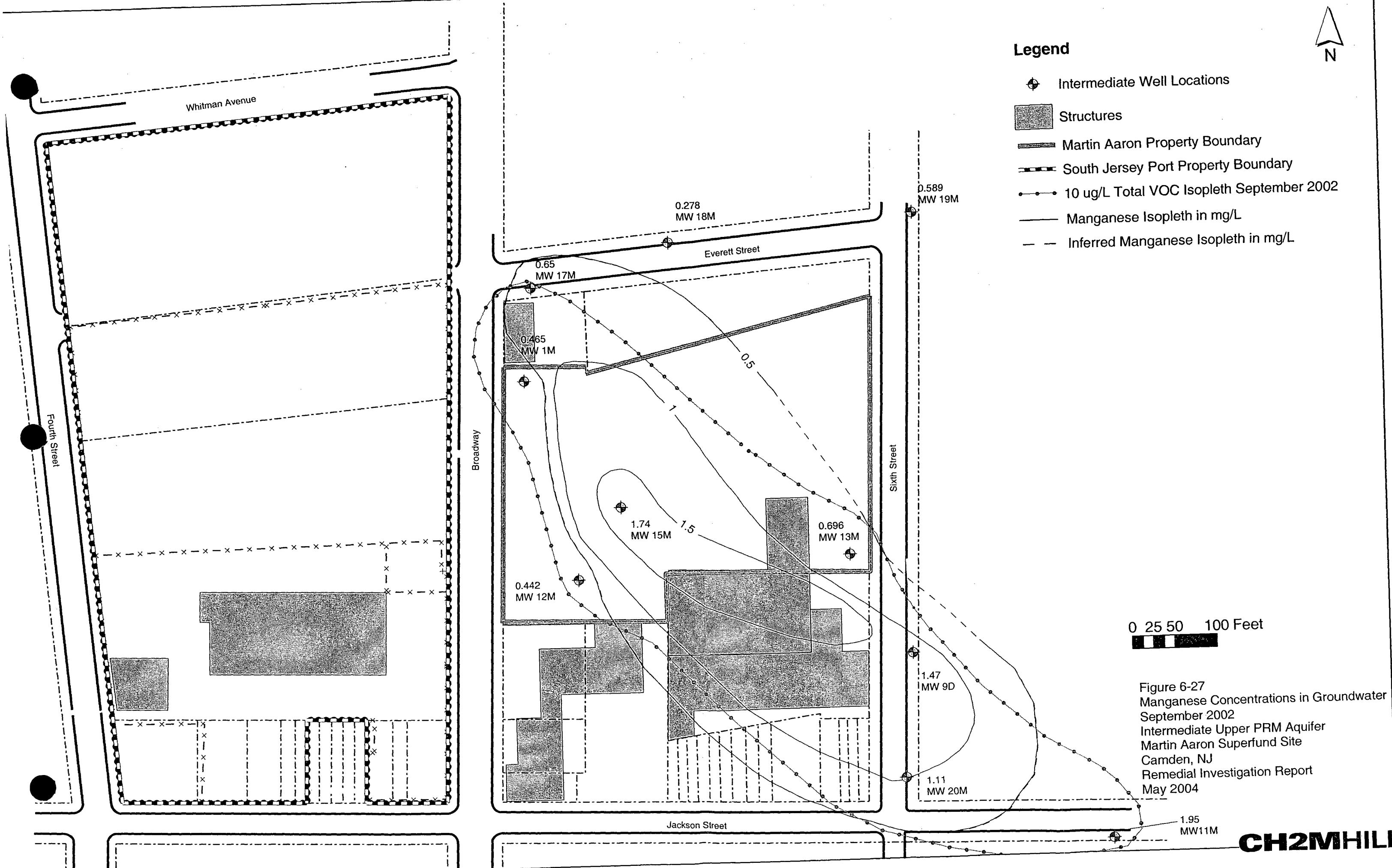
0 25 50 100 Feet

Figure 6-26
Iron Concentrations in Groundwater
September 2002
Intermediate Upper PRM Aquifer
Martin Aaron Superfund Site
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May 2004



Legend

- Intermediate Well Locations
- Structures
- Martin Aaron Property Boundary
- South Jersey Port Property Boundary
- 10 ug/L Total VOC Isopleth September 2002
- Manganese Isopleth in mg/L
- Inferred Manganese Isopleth in mg/L



0 25 50 100 Feet

Figure 6-27
Manganese Concentrations in Groundwater
September 2002
Intermediate Upper PRM Aquifer
Martin Aaron Superfund Site
Camden, NJ
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**Legend**

- ◆ Intermediate Well Locations
- Structures
- Martin Aaron Property Boundary
- - - South Jersey Port Property Boundary
- 10 ug/L Total VOC Isopleth September 2002
- Alkalinity Isopleth in mg/L
- - - Inferred Alkalinity Isopleth in mg/L

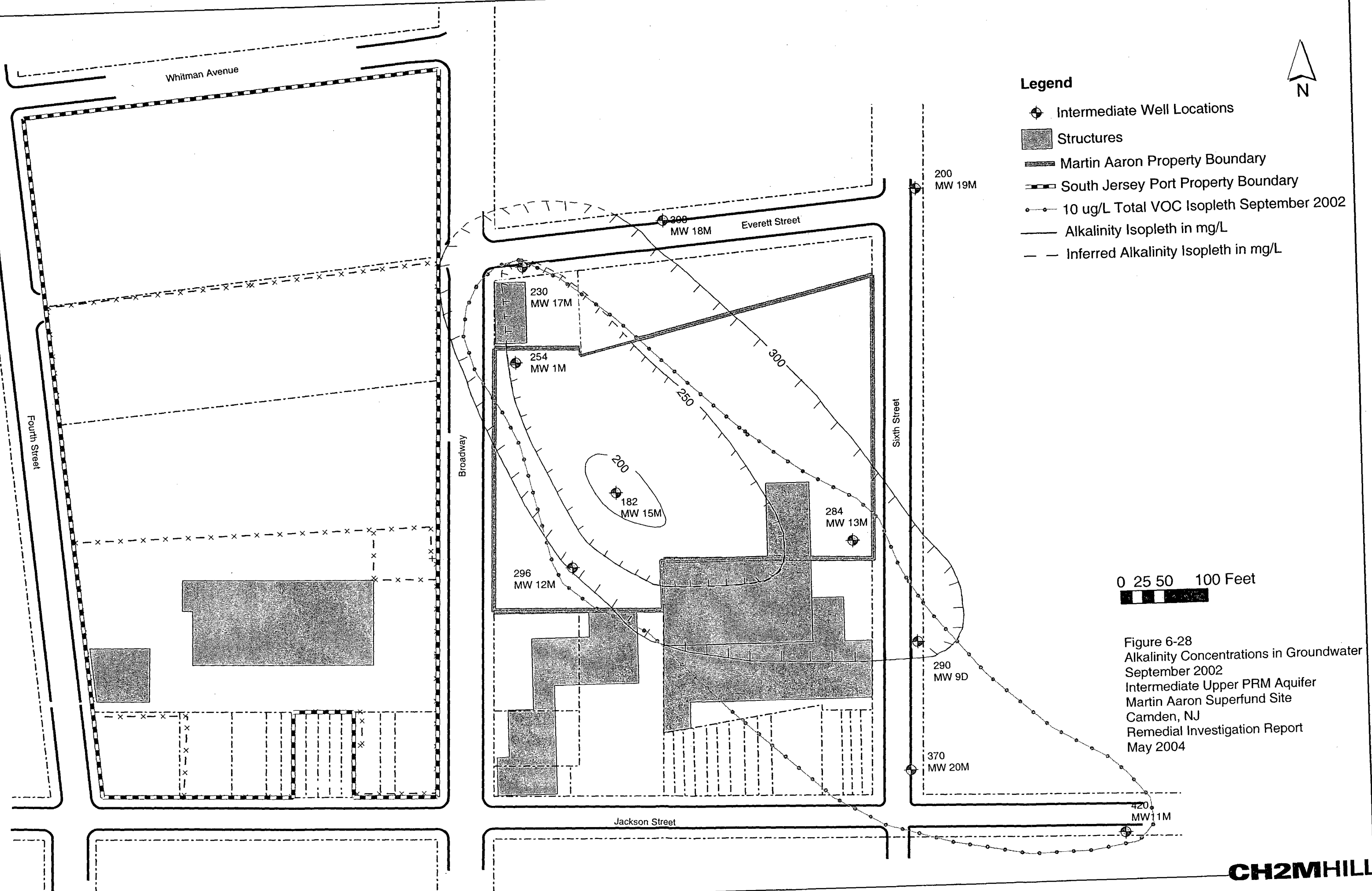







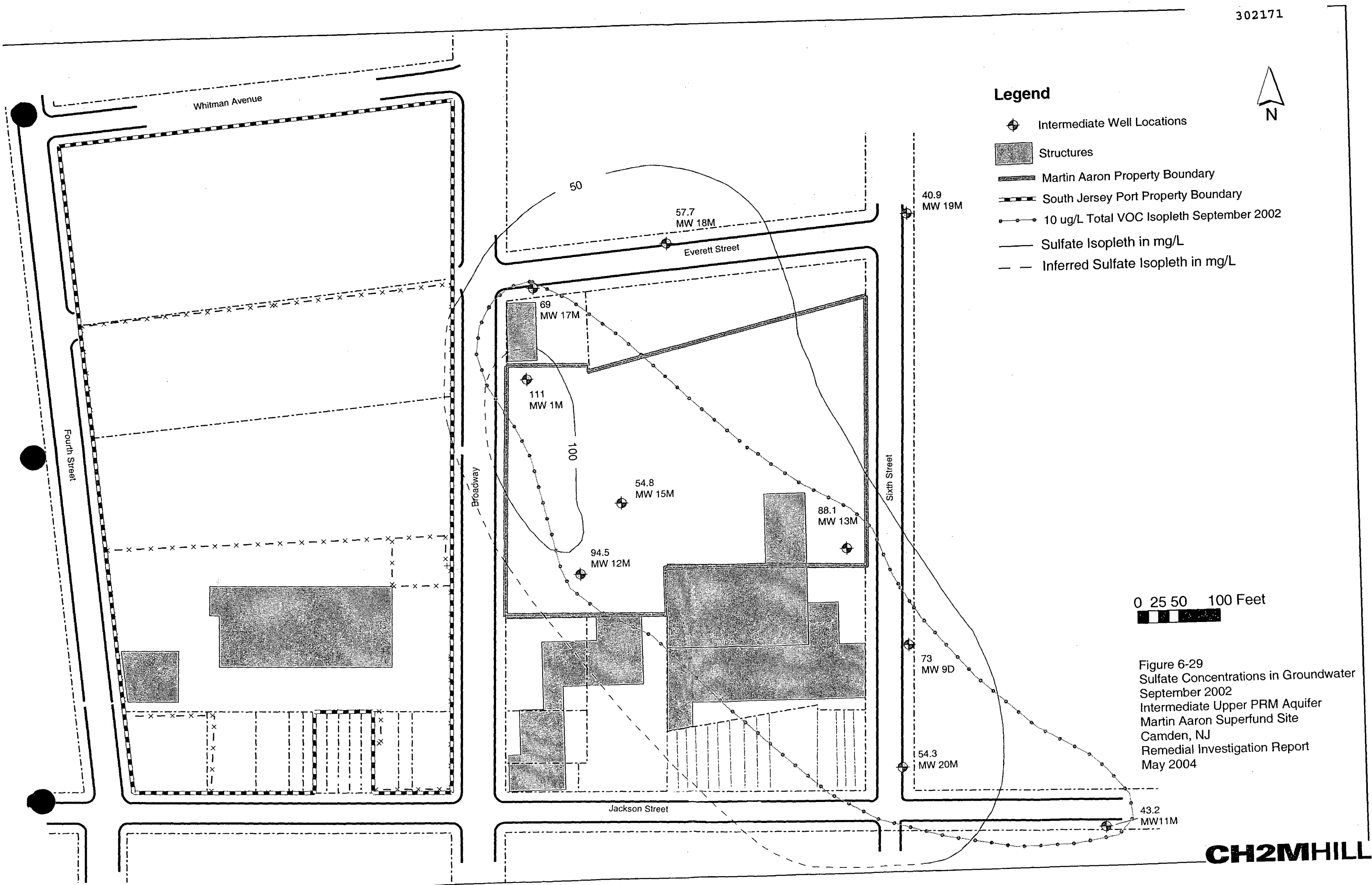


Figure 6-28
 Alkalinity Concentrations in Groundwater
 September 2002
 Intermediate Upper PRM Aquifer
 Martin Aaron Superfund Site
 Camden, NJ
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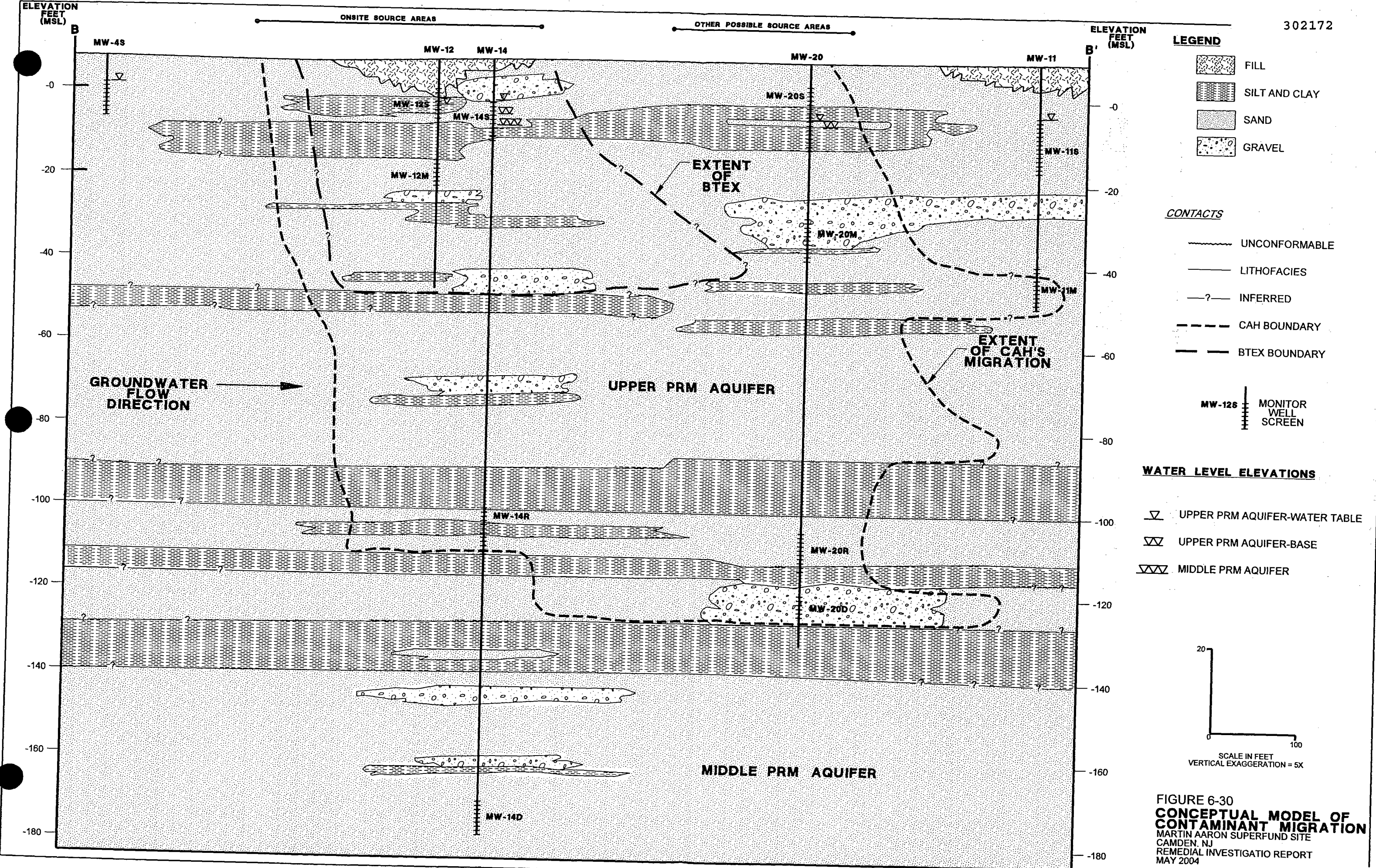
Legend

-  Intermediate Well Locations
-  Structures
-  Martin Aaron Property Boundary
-  South Jersey Port Property Boundary
-  10 ug/L Total VOC Isopleth September 2002
-  Sulfate Isopleth in mg/L
-  Inferred Sulfate Isopleth in mg/L



0 25 50 100 Feet

Figure 6-29
Sulfate Concentrations in Groundwater
September 2002
Intermediate Upper PRM Aquifer
Martin Aaron Superfund Site
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7. Baseline Human Health Risk Assessment

The Human Health Risk Assessment (HHRA) is provided as Appendix I to this RI Report.

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8. Ecological Risk Assessment

The Screening Level Ecological Risk Assessment (SLERA) is provided as Appendix J to this RI Report.

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9. Conclusions

This section provides a summary of conclusions based on the results of the RI.

9.1 Site Geology/Hydrogeology

9.1.1 Site Geology

The subsurface beneath the Site was evaluated by installing 60 soil borings and 12 monitoring well borings at depths ranging from 8 to 190 ft bgs. The subsurface can be separated into one anthropogenic and three time-stratigraphic units that are classified according to their time of deposition. The anthropogenic layer consistently ranges from approximately 6 to 10 ft bgs throughout the Site. The thickest layers are located near the Rhodes Drum Building, and the former Martin Aaron Building. This layer consists mainly of fill material and debris including concrete, asphalt, wood, glass, brick, slag, and fly ash mixed with fine/medium grained sand. This fill material transitions into the Freehold-Downer-Urban Land Complex Association which consists of a grayish brown silt and sand mixture.

Anthropogenic materials are underlain by from youngest to oldest: the Late Cretaceous Magothy Formation, the Early Cretaceous Potomac Group, and the Cambrian Wissahickon Formation. The Magothy Formations and Potomac Group are composed of unconsolidated, interbedded sequences of coarse to fine, quartzose sand and variegated-colored clay. Total thickness of the Magothy Formation and Potomac Group beneath the site is over 300 feet. Individual sand can range up to 80 feet thick, but most are significantly thinner. Sand units are often coarse and well sorted, exhibiting excellent water transmitting properties. Clay units are often laterally discontinuous, and rarely exceed 15 feet in thickness. The Upper PRM Aquifer is contained entirely within the Magothy Formation, while the Middle and Lower PRM Aquifers lie in the Potomac Group sediments.

The unconsolidated Cretaceous-age sediments are underlain by the Cambrian Wissahickon Formation, which defines the bedrock basement beneath the region. The Wissahickon Formation consists of a quartz-plagioclase-amphibole schist and in some locations, gneiss. Locally the top of the Wissahickon Formation is deeply weathered to a silty clay. Rocks of the Wissahickon Formation exhibit no primary porosity. Water is only transmitted through secondary features such as fracture fabrics (faults, joints, cleavage, etc.).

9.1.2 Site Hydrogeology

The three time-stratigraphic units beneath the Site can be categorized into hydrostratigraphic units according to their hydraulic properties and significance. The Site is underlain by three aquifers and three confining units as follows: the Upper PRM Aquifer, and intermittent confining unit, the Middle PRM Aquifer, a continuous clay confining unit, the Lower PRM Aquifer, and a basal confining unit defined by the Wissahickon Formation. For this RI, only the Upper PRM and the upper portion of the Middle PRM Aquifers were investigated.

9.1.2.1 Upper PRM Aquifer

Beneath the Site, the Upper PRM Aquifer is under unconfined conditions and consists of sandy soils of the Magothy Formation in hydraulic connection with the surficial anthropogenic fill materials. The Upper PRM Aquifer ranges in thickness from 94 ft to 110 ft. The groundwater flow direction in the Surficial Upper PRM Aquifer is to the east-southeast. Observations from nested monitoring wells indicate that vertical gradients throughout the Upper PRM Aquifer are downward. Hydraulic conductivity values as determined from slug tests range below 10 ft/day.

For this RI, the shallow, intermediate, and regional portions of the Upper PRM Aquifer were evaluated during sampling events conducted in June and September 2002. Shallow monitoring wells were set to straddle the groundwater table in the Upper PRM Aquifer. Intermediate monitoring wells were set at approximately the central portion of the Upper PRM Aquifer. Regional monitoring wells were set at the base of the Upper PRM and in an intermittent confining unit between the Middle and Upper PRM Aquifers. The Regional Aquifer refers to the deeper portion of the Upper PRM and does not refer to a regional monitoring well network. The Regional or "R" designated wells at the Site range in depth from 113.0 to 133.0 ft bgs.

9.1.2.2 Middle PRM Aquifer

The Middle PRM consists of sand and gravel of the Potomac Formation approximately 100 ft thick. As only two monitoring wells are screened in the Middle PRM Aquifer, a potentiometric surface map cannot be generated to determine the groundwater flow direction and gradients in the aquifer. Vertical gradients observed in monitor wells are invariably downward between the Upper and Middle PRM Aquifers.

9.2 Soil

Several sources have contributed to the contamination of surface and subsurface soil at Martin Aaron including buried drums of hazardous waste (excavated from depths below the groundwater table), leaking roll-off containers, drums which were stored upside down allowing contents to leak onto the ground, sewer basins which discharged to the subsurface by infiltration, leaking ASTs and USTs, and poor operation and maintenance practices at the Martin Aaron property.

VOC contamination of surface and subsurface soils was most likely caused by solvents used in drum recycling, cleaning, and reconditioning activities. PCE, TCE, cis-1,2-DCE, vinyl chloride, and benzene are the primary COCs in surface soil. These constituents were also found in subsurface soils. Most VOCs in subsurface soil were found at depths from 4 to 5 ft bgs. A few VOCs, such as benzene and TCE, were also found at depths from 8 to 9 ft bgs.

At the Martin Aaron property, contamination in the relatively thin (<10 ft) vadose zone appears to coincide with the contaminant source areas in the fill layer (concrete, asphalt, wood, glass, brick, slag, and fly ash mixed with fine/medium grained sand). The uppermost (anthropogenic) soil layer ranges from approximately 6 to 10 ft bgs throughout the property with the thickest layers located below the former Martin Aaron Building and

the Rhodes Drum Building. This fill material transitions into a grayish brown silt and sand mixture, shown on the cross sections at a depth of about 10 to 12 ft bgs.

The presence of metals and SVOC contamination identified in surface and subsurface soil at Martin Aaron and SJPC may be associated with the ash and cinders in the anthropogenic layer. The ash and cinders are combustion by-products, and were likely used as fill material at the Site. However, some SVOCs were detected at higher concentrations in source areas than in other areas at the Site. A greater number of metals were identified in source areas than in other areas at the Site. Therefore, there is also a site-related contribution to the presence of these compounds at the Site. Similar to the NJDEP RI, this scenario is supported by the apparent lack of contamination identified beneath the southern portions of the former Martin Aaron Building and southern portions of SJPC where less combustion by-products were observed in the subsurface. The lack of contamination beneath the older portions of the former Martin Aaron Building may indicate the placement of the combustion products was probably after the original Martin Aaron buildings were constructed.

COCs in the soil represent a source of contamination to the shallow groundwater. Precipitation on the ground surface that does not exit the property as runoff percolates downward to the water table. During this downward infiltration, the water leaches from the contaminated soils. Contaminants with sufficient concentrations or solubilities are either washed downward, or are dissolved directly into the groundwater. Because this process is controlled mainly by gravity, the transport of contaminants in the vadose zone is primarily downward, directly to the water table, with little to no lateral migration from the source areas. Sources such as the former buried waste (in drums), was deposited below the water table and discharged contaminants directly to the groundwater.

9.3 Groundwater

9.3.1 Upper PRM Aquifer

COCs in the Upper PRM Aquifer include:

- VOCs including cis-1,2-DCE, TCE, PCE, 1,1-DCA, 1,2-DCA, 1,2-dichloropropane, 1,2,4-trichlorobenzene, 1,1,1-TCA, vinyl chloride, xylene, and benzene;
- SVOCs including n-nitrosodiphenylamine, phenol, and bis (2-chloroethyl) ether;
- Metals including aluminum, antimony, arsenic, barium, cadmium, chromium, iron, lead, manganese, sodium, and thallium;
- Dieldrin was the only pesticide detected; and
- No PCBs were identified.

VOCs and metals were detected above screening levels (the more stringent of the MCL or NJ GWQC) in the shallow, intermediate, and regional portions of the Upper PRM Aquifer. Metals were found to be elevated in the shallow aquifer at most sampling locations throughout the Site including Martin Aaron, SJPC, Everett Street, and Sixth Street. In the intermediate portion of the Upper PRM Aquifer elevated metals were found in Martin Aaron, Everett Street, and Sixth Street monitoring wells. In the regional portion of the

Upper PRM Aquifer elevated metals were found on the property near the former Martin Aaron Building and Sixth Street sampling locations. Metals are likely to be associated with the presence of fill material. In addition, elevated concentrations of metals at Martin Aaron may be attributable to solvents used in drum recycling, cleaning, and reconditioning operations causing naturally-occurring metals (manganese, sodium, iron) to leach into the groundwater.

The horizontal extent of groundwater contamination in the Surficial Upper PRM Aquifer has not been delineated to levels below detection for VOCs to the east, southeast, and south of the Site.

Once in the Surficial Upper PRM Aquifer, the contaminants are transported both vertically and laterally, spreading outward and along the path of groundwater flow away from the original source areas.

9.3.2 Middle PRM Aquifer

No VOCs were detected in the two wells screened in the Middle PRM Aquifer. However, VOCs were detected in MW-20D which is screened in an isolated sand unit between the Upper and Middle PRM Aquifers.

In the Middle PRM Aquifer, metals were elevated at Martin Aaron and upgradient and downgradient wells on Sixth Street on the property. Elevated metals include aluminum, beryllium, iron, lead, manganese, sodium, and thallium. These metals are known to occur naturally in the PRM Aquifer. No SVOCs, pesticides, or PCBs were detected in the groundwater in the Middle PRM Aquifer.

The vertical extent of contaminant migration is delineated by the relatively continuous clay layer between the Upper and Middle PRM Aquifers at a depth of approximately 140 feet below ground surface. The lateral extent of contaminant migration is beyond the downgradient monitoring wells surrounding Martin Aaron.

Although the groundwater velocities at Martin Aaron indicate that contaminant migration from drum recycling activities at Martin Aaron could extend for more than a mile, the rapid decrease in concentration within the monitoring well network indicates that the groundwater contaminant plume is influenced by natural attenuation mechanisms.

10. Recommendations

This section identifies preliminary recommendations based on the findings of the RI. However, these recommendations will be reevaluated based on the results of the HHRA and ERA.

10.1 Soil

VOC contamination has been characterized in the surface soil within the limits of the Martin Aaron property. Surface soil samples collected at properties surrounding Martin Aaron including Comarco Products, Ponte, the scrapyard, and along Sixth Street had no concentrations of VOCs above screening levels. VOC contamination at Martin Aaron has migrated into subsurface soils. Therefore, it is recommended that remedial actions be evaluated as part of the FS, in order to address contaminated surface soil at the property.

As described in Section 5.3.1.2, SVOCs were detected at 58 of 60 surface soil sampling locations at Martin Aaron, Comarco, Ponte, and SJPC. SVOCs did not exceed screening levels in surface soil samples collected to the north of Martin Aaron at the scrapyard, Everett Street, or Sixth Street sampling locations. SVOCs were generally distributed across the Martin Aaron property, with most concentrations above screening levels focused in areas of former drum recycling operations. This supports the conclusion that there is a site-related contribution to the SVOC contamination at the Site, specifically in areas of former drum recycling operations. However, the presence of SVOCs above screening levels in soil outside of operational areas at the Site, and at Comarco, Ponte, and SJPC properties is suspected to be related to the use of fill material at these properties.

Metals above screening levels were detected in virtually all of the surface soil samples collected from Martin Aaron and the surrounding properties. Therefore, it is suspected that metals exist at elevated levels due to the presence of historic fill material at the Site and surrounding properties. However, the highest concentrations of certain metals, including arsenic and lead, were found in suspected source areas at the Martin Aaron property. This suggests that there may also be a site-related contribution of metals contamination from the former drum recycling operations at Martin Aaron.

This RI did not include an off-site soil investigation to identify the presence of contaminated fill material in the area of the Site. However, it is recommended that any information available in the literature that confirms the use of fill material, or identifies the presence of contaminated fill material at the Site, or in the surrounding areas, should be considered in the development of the final remedy for the Site.

Elevated PAHs were identified in subsurface soil upgradient from Martin Aaron, in the northeastern corner of SJPC. It is suspected that this contamination resulted from operations at a former service station located to the north of SJPC. Since this area represents a "hot spot" of PAH contamination, an investigation of the source of contamination, and an

evaluation of remedial alternatives to address soil contamination in this area is recommended.

During this RI, surface soil samples could not be collected from the yards of the residences located on Jackson Street due to access issues. However, it is recommended that surface soil sampling be attempted again in order to adequately quantify human health risk of direct contact with surface soil at these properties.

10.2 Groundwater

VOC contamination in the shallow aquifer is primarily limited to within the property boundary. However, the presence of a detectable concentration of benzene in upgradient well MW-18S suggest the potential presence of an upgradient source of VOC contamination in the shallow groundwater. In order to verify the presence of an upgradient source, an additional monitoring well would need to be placed to the north of Everett Street.

Additional groundwater monitoring should focus on characterizing contamination in the deeper portion of the hydrostratigraphic section including the Middle PRM Aquifer at the MW-9, MW-11, MW-19, and MW-20 clusters, the base of the Upper PRM Aquifer at the MW-9, MW-11, MW-12, MW-14, MW-17, MW-18, and MW-20 clusters, and in the thin, intervening sand unit between the main sand units of the Upper and Middle PRM Aquifers at the MW-9, MW-12, MW-11, and MW-17 clusters. Deep borings, particularly at MW-17, MW-19, and MW-20 clusters, will permit triangulation of the important stratigraphic units across the Site, accommodating selection of screen intervals for monitoring wells at the base of the Upper PRM Aquifer, in the thin sand between the units, and in the Middle PRM Aquifer. The borings should be geophysically logged for a typical stratigraphic suite of parameters such as natural gamma, spontaneous potential, single point resistance, and normal resistivity logs. After logging, the borings should be abandoned or converted to monitor well borings.

In general, contaminant concentrations in groundwater have been delineated to applicable screening levels at the Site. However, prior to the implementation of a remedial design, additional monitoring wells and rounds of groundwater monitoring are recommended to fully characterize contaminant distribution within the plume.

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